APPENDIX C

Alternatives Development Process

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1. Purpose of Appendix

This appendix further explains the alternatives development process, provides the option screening criteria and summarizes each step of the process.

2. Context and Requirements

The federal regulations governing the *National Environmental Policy Act* (NEPA) state in 40 CFR 1502 that the alternatives section "is the heart of the environmental impact statement." The regulations require federal agencies to "rigorously explore and objectively evaluate all reasonable alternatives and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated." The Council on Environmental Quality (CEQ) circulated a guidance document entitled, *NEPA's Forty Most Asked Questions*, which states:

> *In determining the scope of alternatives to be considered, the emphasis is on what is 'reasonable' rather than on whether the proponent or applicant likes or is itself capable of carrying out a particular alternative. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant.*

3. Overview of the Alternatives Development Process

Alternatives Development Process Challenge

To fully consider the approximately 2,600 discrete comments received during scoping throughout the alternative development process.

Scoping yielded a wide variety comments which provide input to the alternatives development process. The lead and cooperating agencies used a structured, five step alternatives development process in order to recognize the project's large geographic footprint, the three components (mine site, transportation facilities, and pipeline), and the robust participation by the public, stakeholders, and agencies in scoping.

To fully consider the wide range of issues identified in the scoping comments, this alternatives development process used the concept of options, which consist of variations of components and subcomponents of the proposed project (mine site, transportation facilities or pipeline). For example, an option for energy supply at the mine site could be a liquids pipeline instead of barging diesel fuel on the river. Individual pipeline route variations would also be considered as options.

Alternatives Development Process

Step 1: *Identify scoping issues and related project components*

Step 2: *Identify option screening criteria*

Step 3: *Identify options to address concerns for each component and subcomponent*

Step 4: *Apply screening criteria to all options; develop options to carry forward and carefully document option disposition*

Step 5: *Package options into Action Alternatives*

To summarize this process, Step 1 identified the issues derived from scoping and related them to project components and subcomponents. Step 2 developed the criteria to screen options for feasibility. Step 3 identified options to address scoping concerns for each project component and subcomponent. Step 4 applied the criteria developed in Step 2 to screen the options identified in Step 3. Step 5 compiled the alternatives in Chapter 2, Alternatives of the EIS.

The Corps and cooperating agencies reviewed the outputs of each step in the alternative development process. The end result was to identify action alternatives for full analysis in the EIS. NEPA regulations also require that a No Action alternative be analyzed. In this case, the No Action alternative would assume that the mine, transportation facilities, and pipeline would neither be permitted nor constructed. Donlin Gold's proposed project is the proposed action for analysis in this EIS.

4. Step 1: Issues, Components, and Subcomponents

In Step 1 the scoping issues were linked to Donlin Gold Project components or subcomponents. Table C-1 summarizes scoping comments that suggested alternatives to be considered in the EIS. The results of Step 1 were revisited in Step 3, refined in Step 4, and proposed in final form in Step 5, leading to the alternatives for full analysis, as described in Chapter 2 of the EIS.

5. Step 2: Screening Criteria

This step identified criteria to assess options and reasonable alternatives to the proposed action drawing on the NEPA regulatory intent to "avoid or minimize adverse effects of these actions upon the quality of the human environment" (40 CFR 1500.2 Policy (e)). In Step 2, criteria were developed to use in rating options. This allowed for agency review prior to the application of these criteria in the screening of options. The criteria were organized around three screening tests used to narrow the range of options considered:

- Purpose and Need: Options that do not meet the Corps' determination of Overall Project Purpose and NEPA Purpose and Need were not analyzed further in the EIS. Similarly, any options to the pipeline component that fall outside of the BLM Purpose and Need statement were not considered further. The purpose and need statements for the project are provided in Section 1.3 of the EIS. The evaluation of options relative to purpose and need screening was a simple yes or no rating.
- Feasibility: Options that clearly are not feasible or are impractical from a technological or economic standpoint were not carried forward for analysis in the EIS. The consideration was broader than simply asking if it can be done. This review was intended to flag options that are clearly technically infeasible or technically or economically impractical even though they may be possible.
    - Technological Feasibility: If options cause components to become too complex or to use uncertain technology, an increased risk of operational failure or accidents could result. Certain aspects identified for development and operation of a project component may have technical constraints that affect the ability to implement those components. For example, topography, resource limitations, spatial relationships of one component to another, temporal relationships, or engineering knowledge for a specific option may influence the acceptability of that particular option or approach for meeting the project objectives. This criterion considers the ability of a specific option to meet these challenges.
    - Economic Feasibility: If project costs exceed reasonable or practical limits, economic feasibility could become an issue. Clean Water Act regulations enumerate cost as among the considerations to be factored into whether an alternative is practicable (40 CFR 230.10(a)(2)): "An alternative is practicable if it is available and capable of being done after taking into consideration cost,

existing technology, and logistics in light of overall project purposes." Logistics were implicitly part of this assessment.

- Environmental Impacts: Options were evaluated for their impacts on the physical, biological, and socioeconomic environments. Options that provide avoidance or minimization advantages to the proposed project or other options are considered under NEPA or *Clean Water Act* regulations. Options that have potentially greater impacts to one or more resources, but potentially fewer impacts to other resources, were not eliminated in Step 4. Additionally, should two feasible options be generated to avoid or minimize an impact, but one of those options was determined to have potentially greater impact on the environment—the option with greater impacts may be recommended for elimination from further study.

The objective of these criteria is to guide the screening process, but not to mechanically generate outcomes which substitute for professional judgment. By nature, these criteria are not fine filters. It was not the purpose of the option screening process to judge between trade-offs or make close calls. Rather, the purpose of criteria was to provide a basis to eliminate clearly unreasonable options through an independent, structured process.

Application of Criteria

- *Promote effective screening of options for impacts against the important issues for this EIS*
- *Help recommend elimination of options that are not feasible or do not reduce environmental impacts over similar options*
- *Not designed for cross-issue impact comparison or impact ranking*
  - *Options that have differential environmental impacts among issues may be recommended to be carried forward for further evaluation in screening*
- *Do not substitute for or predict the results of the detailed evaluation of impacts*

6. Step 3: Identify Options to Address Concerns for Each Component and Subcomponent

In Step 3 the options to address concerns for each component and subcomponent were identified. The various design alternatives considered by Donlin Gold were evaluated as options and this decision to include Donlin Gold's design variants markedly increased the number of options. The initial option list was reviewed by the cooperating agencies. The list of options considered is provided in Table C-2 through Table C-4. The tables identify the components, subcomponents, and associated options. The tables also indicate which options are part of the proposed action, other action alternatives, and those that were dismissed from further consideration. Figure C-1 depicts the pipeline route alignments considered.

7. Step 4: Options Screening

This step involved applying the screening criteria of Step 2 to the list of options compiled through Step 3. The intent of this step was to recommend options to be carried forward for further analysis as the building blocks for the action alternatives. Screening in this step also identified which options not to recommend to be carried forward and provided the rationale for eliminating them. An initial report and the option rating sheets were reviewed by the cooperating agencies, with adjustments made on the basis of comments received. The options considered but eliminated from analysis and the rationale for elimination are presented in Table C-5 through Table C-23. The remaining options were packaged into action alternatives in Step 5.

8. Step 5: Package Options into Action Alternatives

In Step 5, options carried forward were packaged into the alternatives described in Chapter 2, and analyzed in detail in the EIS. These alternatives are considered to meet the screening criteria for purpose and need, technological and economic feasibility, and avoiding or minimizing environmental impacts. In accord with NEPA guidelines, the No Action (Alternative 1) and Proposed Action (Alternative 2) alternatives are also included in the range of alternatives analyzed in detail.

The action alternatives vary from the proposed action in key engineering design, siting, and operational features. These alternatives address concerns raised in scoping and provide a reasonable range of alternatives for comparison. For example, in one alternative, the mine site and the pipeline components remain the same as in the proposed action, but two variants (Alternative 3A and Alternative 3B) are evaluated to reduce the amount of barging on the Kuskokwim River.

Table C-1: Summary of Scoping Comments Identifying Alternatives Being Considered

Scoping Issue	Components, Sub-Components, Sub-Component Aspects or Options
• Explore alternative mine plans that may extend the mine life by reducing the daily tonnage produced to reduce energy demands that could be generated through more local options. • Evaluate mine plans to consider the effects of noise to human health, birds and wildlife.	• Mine Site – Surface Mining o Blasting – Ore Processing/Milling – Power plant
• Consider alternatives to using cyanide. • Explore alternatives that eliminate or reduce the risk posed by mercury contamination, acid drainage and metal leaching. • Evaluate alternative methods for managing waste liquid flows from the carbon-in-leach tank and other mill processes to the tailings pond. • Explore pollution control measures that can reduce the mercury in the carbon-in-leach tailings solution before it gets mixed with the detoxified tails. • Assess adequacy of the amount and supply of buffering material (i.e., limestone) to counteract formation on acid drainage over the long run. • Consider alternatives to reduce the length and number of mine site pipelines – Consider insulated pipes to carry contaminants.	• Mine Site – Ore Processing/Milling o Carbon-In-Leach o Cyanide Detoxification o Mercury Abatement System – Tailings Storage Facility (TSF)
• Consider alternatives that provide safety systems in the event of a release or dam failure.	• Mine Site – TSF
• Evaluate the risk of leaching arsenic, including possible limitations on the types/categories of Non-Acid Generating (NAG) rock that would go into the waste rock facility (WRF).	• Mine Site – WRF

Table C-1: Summary of Scoping Comments Identifying Alternatives Being Considered

Scoping Issue	Components, Sub-Components, Sub-Component Aspects or Options
• Explore alternatives to impoundment lakes including paste tailings and dry stacking. • Evaluate alternative engineering plans that would eliminate the need for water treatment in perpetuity or beyond a 10-year post-reclamation horizon. • Include an alternative in which tailings pond leachate does not report to the mine pit or any other long-term storage solution. • Assess alternatives that employ redundant and backup water management and treatment systems. • Consider an alternative in which the mine does not dump captured mercury into the tailings pond. • Exports mercury to a federally approved permanent storage facility with a multiple container approach preferably by air.	• Mine Site – TSF – Water treatment plant – Barge Traffic – Angyaruaq (Jungjuk) Port – Airstrip
• Consider the following alternatives to a pipeline: – A system transmitting power by wire from Bethel to the mine site. – Pumped hydro option to store energy with liquefied natural gas (LNG) as the primary source. – Wind power, run-of-river hydroelectric generation, solar power, bio fuels and energy conservation measures.	• Mine Site – Energy Source – Power Plant
• Evaluate paving the mine access road.	• Transportation Facilities – Mine Access Road
• Comments expressed preference for alternatives that do not increase barge traffic. • Evaluate alternative locations for the proposed port facilities. • Evaluate the use of winter ice roads and snow roads for transportation of cargo and fuel to the mine site. • Evaluate the possibility of a fluid pipeline to reduce barge traffic.	• Transportation Facilities – Bethel Cargo Facility – Barge Traffic – Angyaruaq (Jungjuk) Port
• Evaluate improving the Crooked Creek airstrip. • Evaluate use of Puntilla airstrip.	• Transportation Facilities – Airstrip • Pipeline
• Consider rerouting the pipeline at least two and one-half miles west towards Nikolai and away from the Alaska Range to reduce the indirect impacts of hunters following the pipeline to access hunting areas. • Explore alternatives to avoid or further reduce co-location with the Iditarod National Historic Trail.	• Pipeline (routing alternatives)
• Evaluate alternatives to reduce impacts on vegetation including: – Reduce the initial clearing requirements to less than 50 feet for the majority of the right-of-way. – Alternatives that do not require clearing of the right-of-way every 10 years. – Avoiding the need for substantial grading of hillsides. – Alternatives that minimize needs from material sites.	• Pipeline (general alternatives) – Material Sites
• Evaluate an above ground pipeline as opposed to a buried pipeline. • Assess the ramifications of pressure loss or leaks – Risk of third-party damage. • Consider alternative placement of valve stations to avoid visual impacts to local businesses.	• Pipeline – Buried Pipe

Table C-1: Summary of Scoping Comments Identifying Alternatives Being Considered

Scoping Issue	Components, Sub-Components, Sub-Component Aspects or Options
• Evaluate alternatives in the pace of operations to reduce the demand at peak employment and spread out the mine impacts on over a longer period of time.	• Mine Site
• House pipeline construction workers at existing lodges.	• Pipeline

Abbreviations:

LNG = liquefied natural gas

NAG = Non-Acid Generating

TSF = Tailing Storage Facility

WRF = waste rock facility

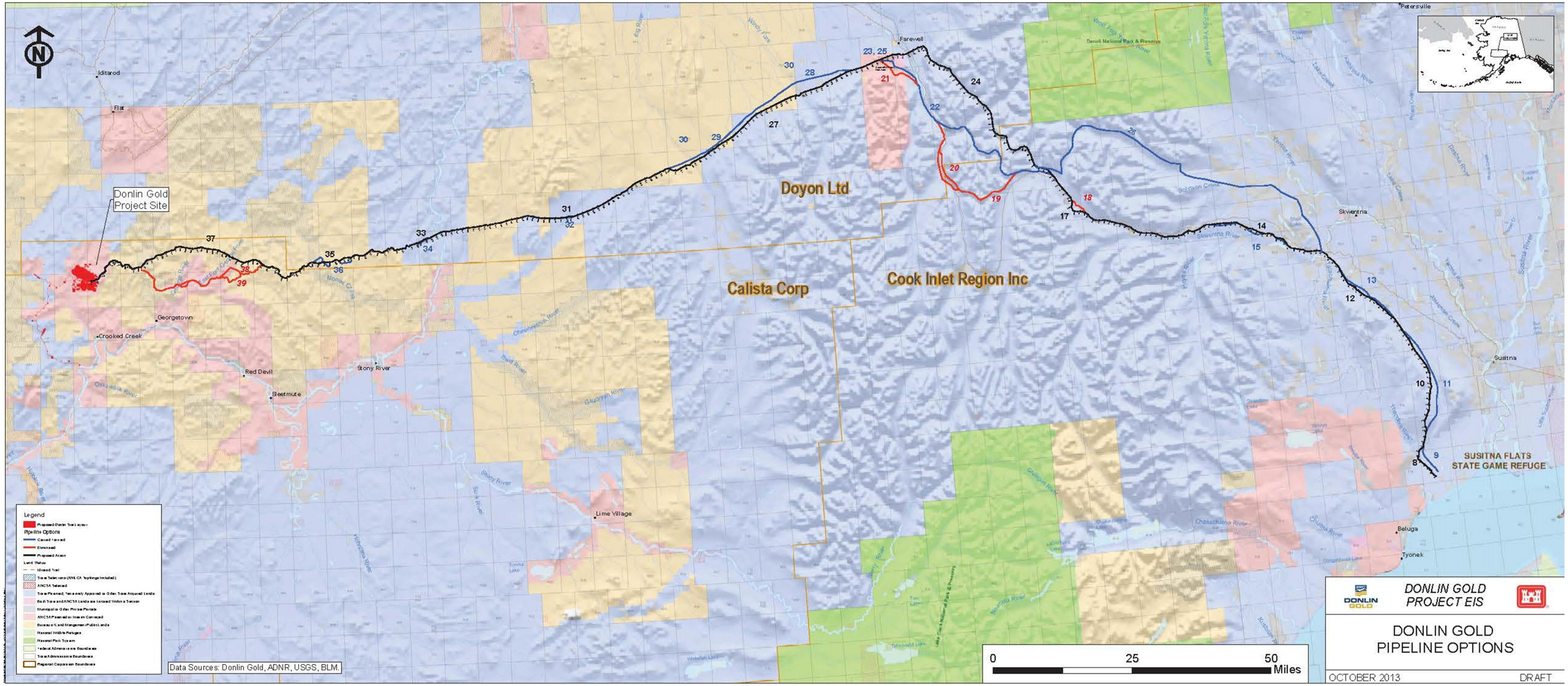

Figure C-1: Donlin Gold Pipeline Options

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Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Surface Mining and Pits	**Ore Extraction**	MS-1	Surface Mining	Proposed action. Creates an open pit as ore is extracted.
		MS-2	Underground mining	Underground mining involves the construction of tunnels, shafts, or adits to reach the ore, which potentially reduces the amount of waste rock and tailings generated, as well as the surface footprint of the mine.
		MS-3	Surface & underground mining	This option could reach near-surface ore through a pit and deeper ore by installing tunnels, potentially combining the benefits of the easier excavation of a pit, with the reduction of waste rock and tailings of underground mining.
	Surface Mining: Pit Variations **(assumes option 1)**	MS-4	Flatten pit-walls to reduce risk of slope failure	Evaluated the risk and benefits of various slope angles and assessed potential large-scale slope failure.
		MS-5	Grout pit-wall and floor	Option to control water flow through pit wall to reduce water infiltration.
		MS-6	Install well point dewatering system	Proposed action. Uses groundwater extraction from wells to lower the water table below the pit floor.
		MS-7	Allow runoff to enter the pit	Water would flow into the pit where it would be pumped out.
		MS-8	Construction of diversion berms/channels to reduce or eliminate runoff entering the pit	The proposed action would construct a berm on American Creek upstream of the pit to deter rainwater runoff from entering the pit during operations.
	Loading Equipment	MS-9	Diesel shovels (only)	Two fuel options for loading equipment/shovels. The proposed action is a mixed fleet of diesel and electric shovels.
		MS-10	Diesel and electric shovels	
	Hauling Equipment	MS-11	Trolley-assist system	• MS-11 through MS-14 are options for hauling mined material. • Diesel powered haul trucks are the proposed action. • LNG trucks are considered in Alternative 3A.
		MS-12	Conveyor system	
		MS-13	LNG Trucks	

Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Surface Mining and Pits (continued)	**Hauling Equipment (continued)**	MS-14	Diesel Trucks	
Ore Processing/ Milling	**Processing Technique**	MS-15	Heap Leaching	In the heap leaching process, gold is extracted directly from the crushed ground ore, placed on a lined pad, and the gold containing solution is collected by gravity flow across the heap.
		MS-16	Milling	The Applicant's proposed milling process includes crushing, grinding, flotation, pressure oxidation, cyanide leaching, and gold refining.
	Milling Location (assumes option MS-16)	MS-17	Off-Site Concentrate	Gold-bearing, sulfidic minerals are separated from non-gold-bearing rock using a floatation technique. The resulting material would be a concentrated slurry that could be shipped offsite for processing.
		MS-18	On-Site Process	Ore is processed onsite to produce doré bars.
	On-Site Options (assumes option MS-18)	MS-19	Autoclave - Pressure Oxidation (POX)	Use autoclave technology to oxidize ground ore under high temperature and pressure and by adding large quantities of oxygen.
		MS-20	Roasting	Ground ore is oxidized to convert sulfide mineralization to oxides, which thus becomes more suitable for carbon-in-leach extraction.
		MS-21	Biological Oxidation	Microorganisms oxidize sulfides in the concentrated ore, allowing encapsulated gold to be removed during the cyanide process.
	POX Options (assumes option MS-19)	MS-22	Whole Ore	POX would process all of the ore.
		MS-23	Concentrate	Other processes would concentrate the ore prior to POX.
	Chemical Extraction	MS-24	Cyanide	In the proposed action carbon-in-leach (CIL) circuit, a cyanide solution would dissolve the gold from the concentrated ore. The dissolved gold would be adsorbed onto granular, activated carbon particles.

Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Ore Processing/ Milling (continued)	**Chemical Extraction (continued)**	MS-25	Thiosulfate	Thiosulfate (with the addition of ammonia and cupric ion) is used to extract gold.
		MS-26	Thiourea	Thiourea is used to extract metals.
		MS-27	Bromine	This technology uses bromine and sulfuric acid for gold extraction from roasted ore.
		MS-28	Combination of Cyanide and Other Extracting Chemicals	This technology would use a combination of cyanide and other extraction chemicals to reduce the overall cyanide use.
	Plant Locations	MS-29	Lower American Ridge	Two possible plant locations; Middle American Ridge is the proposed action.
		MS-30	Middle American Ridge	
Ore Throughput (applies to all subcomponents)	**Variations of Ore Throughput**	MS-31	Throughput Option 20,000 Tons/day	Five potential levels of production throughput. These options could be subject to change because of low-water days or barge problems. 59,000 short tons per day is the proposed action.
		MS-32	Throughput Option 30,000 Tons/day	
		MS-33	Throughput Option 59,000 Tons/day	
		MS-34	Throughput Option 75,000 Tons/day	
		MS-35	Throughput Option 100,000 Tons/day	
Water Treatment (applies to all subcomponents)	**Management of Waste Liquid Flows from CIL Tailings Solution Prior to Mixing with Detoxified Tailings**	MS-36	Treatment and/or Recycling of the CIL Liquids for Process Water	The proposed action is to reuse/recycle the CIL liquids.
	Process Pipelines	MS-37	Reduce the Length, Number, and Vulnerability of Process Pipelines	Reduce the length and number of pipelines while decreasing the vulnerability through assessment of the materials, placement, protection, and maintenance of pipelines.

Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option	Description
			Proposed Action / Alternatives / Dismissed / Potential Mitigation	
Water Treatment (applies to all subcomponents) (continued)	**Ensure Adequate Water Treatment Capacity with Additional Treatment Tanks and Pumps**	MS-38	Applicant's plan of development includes treatment of pit dewatering water, not contact or process water. Capacity includes a freshwater reservoir, two contact water ponds, and a raw water tank.	Water treatment plants would be designed using standard practices.
		MS-39	Increase Tank Capacity by 50%	Provide redundancy and reduced risk of treatment plant shutdown.
		MS-40	Increase Pumping Capacity by 50%	Provide redundancy and reduced risk of treatment plant shutdown.
		MS-41	Add Backup Power Supply	Provide redundancy and reduced risk of treatment plant shutdown.
	Water Management Operations	MS-42	Zero-discharge option	Keep all water on-site.
		MS-43	Treatment and Discharge of Pit Dewatering and Storage/Use/Re-use of Process and Contact Water	Discharge treated water from pit dewatering wells. Store, use, and reuse all process/contact water.
		MS-44	Treatment and Discharge of all Water	Discharge all water after appropriate treatment. Would require water from a new source for process water.
	Long-term Water Management (post closure)	MS-45	Reverse osmosis	Use reverse osmosis to treat excess water affected by cyanide and metals.
		MS-45a	Alternatives to the Octolig columns for treatment of selenium	Use alternative treatment methods to treat selenium in the pit lake water effluent post closure. Models predict the pit lake will be nearly full and require pumping and treating approximately 50 to 55 years after closure.

Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option				Description
			Proposed Action	Alternatives	Dismissed	Potential Mitigation	
Water Treatment (applies to all subcomponents) (continued)	**Long-term Water Management (post closure) (continued)**	MS-46	Long-Term Treatment of Pit Lake Water (Perhaps in Perpetuity)				It is anticipated that the water on the surface of the pit lake would not meet water quality criteria for several parameters and thus would be treated before discharge into Crooked Creek. Water discharged from the pit would be managed by passing it through a post-closure High Density Sludge Process Water Treatment Plant (WTP), where chemical precipitation technology would be applied to remove elements such as aluminum, antimony, arsenic, manganese, mercury, and selenium. The sludge from the WTP would be a chemically stable material that would be sent to the bottom of the pit lake for final storage.
Water Treatment Mine Site Infrastructure	**Sanitary Waste Water Treatment**	MS-47	Modular Sanitary Waste Water Treatment Plants				Two modular sanitary treatment plant (STP) systems would be provided: one for the permanent facility and one for the construction camp immediately west of the plant site. The construction camp STP would later be reduced in size to accommodate the operations work force. Domestic wastewater from the various sources would be pumped to the STPs via insulated and heat-traced overland pipelines or, in pipelines running through heated utilidors. The STPs would process the domestic wastewater and produce treated effluent, which would be placed into the Tailings Storage Facility (TSF), and a filtered sludge, which would be burned in the on-site incinerator. Treated effluent from both plants would be discharged through separate insulated and heat-traced high-density polyethylene overland pipelines to the TSF.
Water Treatment Angyaruaq (Jungjuk) Port	**Sanitary Waste Water Treatment**	MS-48	Septic and Leach Field				A septic tank and leach field sized for the maximum anticipated crew (approximately 20 workers) would be installed at the Angyaruaq (Jungjuk) Port. The leach field would be placed in an appropriate location, considering soil conditions, floodplains, and traffic. The tank would be pumped out as necessary.

Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option Proposed Action / Alternatives / Dismissed / Potential Mitigation	Description
Mercury Abatement	**Mercury Abatement Systems**	MS-49	Mercury abatement and emission control systems at: • Pressure oxidation • Hot cure • Electrowinning • Retort • Refinery furnace • Carbon regeneration kiln	Due to the elevated temperatures, some mercury would be expected to volatilize into the gas stream leaving each of these areas. Fume hoods and ducting would be used to transport the gas to the mercury scrubbing systems, where mercury would be removed. Mercury would be collected and disposed of in two forms: condensed liquid, which would be collected in specialized flasks, and mercury-loaded carbon. Both would be shipped off site to a regulated storage facility. All mercury abatement systems would follow a similar general flow sheet, but there would be some variations driven by the differences in mercury concentration and type of mercury present in the gas stream. The design principle consists of gas quenching, particulate removal, refrigeration to condense elemental mercury, and final polishing of the gas streams by carbon beds.
Mercury Handling **(applies to Ore Process/Milling and TSF Subcomponents)**	**Mercury Disposal**	MS-50	On-site mercury-disposal-specific landfill	Build a small hazardous waste landfill on site for mercury-containing waste disposal.
		MS-51	On-site mercury recycling facility	Build mercury recovery/refining/recycling facility to recover mercury from mercury-loaded carbon.
		MS-52	Barge transport of Mercury to an Approved Off-site Disposal Facility	Two transport methods considered to an approved off-site mercury storage facility. Barge transport is the proposed action.
		MS-53	Air Transport of Mercury to an Approved Off-site Disposal Facility	
		MS-54	Off-site Mercury Recycling Facility	This option considers transporting mercury waste to a commercial mercury recycling facility for recovery of mercury from mercury-loaded carbon.
Cyanide Handling	**Cyanide Disposal**	MS-55	Cyanide Destruction	Use sulfur dioxide to destroy cyanide.
		MS-56	Cyanide Neutralization Using Cyanochlor	Use a proprietary neutralization agent.
		MS-57	Dispose Waste Containing Residual Cyanide on Site	Build a small landfill to dispose of waste containing residual cyanide on site.

Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
TSF	**TSF Type**	MS-58	Segregated (sand/slime splitting –SSS)	In SSS the tailings are put through a centrifuge and the overflow (fine particles) is handled as tailings.
		MS-59	Single	A single facility for combined tailings streams.
		MS-60	Neutralize Potentially Acid Generating (PAG) Waste Rock	Mix the tailings with acid-generating rock to homogenize the pH.
		MS-60a	Neutralize PAG Waste Rock by Placing in Completed Pit	Stockpile all PAG waste rock instead of placing in WRF. At end of mining, return to pit.
		MS-61	Segregate Arsenic Containing Tailings for Separate Handling	In this option the tailings stream would be chemically segregated and the arsenic containing portion would be disposed of separately.
		MS-62	Chemically Treat Tailings before it is Discharged to the TSF	In this option the tailings stream would be treated with the addition of buffering agent (lime) and/or stabilizing agents (fly-ash, cement) to reduce the mobility of chemical in the tailings.
	TSF Type (assumes option 59), with options for Facility Linings	MS-63	Dry Stack Tailings	Using filter-presses and vacuum-filters, the solid contents can be increased to 80%+, then the tailings are not pumped but delivered using conveyor belts. This option is under consideration as an action alternative.
		MS-64	Paste (thickened) Tailings Disposal	Paste technology involves the use of thickeners to increase the solids content of tailings, normally to the order of 60-65%.
		MS-65	Conventional Wet Tailings Disposal	All the tailings are combined and pumped, usually at about 40-45% solid content.
		MS-66	Unlined Tailings Facility	In this alternative, only the dam wall of the TSF would be lined.
		MS-67	Lined Tailings Facility	In this alternative, the entire floor of the TSF would be lined.

Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
TSF (continued)	**TSF Type (assumes option 59), with options for Facility Linings (continued)**	MS-68	Double Lined Facility	In the alternative the entire floor of the TSF would be lined with a double liner to provide redundancy against leakage and to allow the installation, monitoring, and operation of a leak detection system.
		MS-69	High Performance Liner	Liner materials such as XR5 or BGM would be used to increase resistance against leakage.
		MS-69a	Add Clay Layer to Liner	TSF liner design of a prepared surface topped with a layer of clay, overlain by a permeable layer to provide leak detection, topped with a synthetic liner.
	TSF Design	MS-70	Lined Tailings Facility with an Earthen Dam	The dam would be compacted rockfill with a liner on the upstream face. The tailings impoundment footprint would also be lined.
		MS-71	Install a Secondary Dam Downstream from the TSF to Capture Material Escaping through Spills or Cracks	Would provide a redundant dam to impound material if the primary dam was compromised.
		MS-72	Install Multiple TSFs Filled in an Upstream to Downstream Sequence	In this alternative multiple TSF cells would be constructed to provide downstream protection and capturing of spills.
		MS-73	Flatten TSF Side Slopes to Increase Stability of Dam Wall	Address slope stability and increase safety factors.
		MS-74	Improvement of Foundation Soils	Prior to constructing the dam wall, compact, treat, and improve foundation soils to reduce the possibility of deep seated failure.
Waste Facilities (TSF and WRF)	**Comingled vs. Separate**	MS-75	Comingled Tailings/Waste Rock	Place waste rock and tailings in a single, combined facility.
		MS-75A	Blend PAG 6 into WRF instead of placing in isolated PAG 6 cells	Mixing PAG 6 with NAG may allow better buffering than isolating in cells.
		MS-75B	Install a liner under the WRF	Would place an LLDPE or other low permeability liner under the WRF.

Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Waste Facilities (TSF and WRF) (continued)	**Comingled vs. Separate (continued)**	MS-75C	Install a high permeability layer in the WRF cover	Could help minimize the amount of water infiltrating the waste rock facility.
		MS-75D	PAG 6 in isolated covered cells in WRF	Isolating the PAG 6 and reducing water infiltration is the proposed action.
		MS-76	Separate Tailings/Waste Rock	Proposed action. Separate facilities.
	Alternative Locations (assumes option 76)	MS-77	TSF: Anaconda Creek Valley (Single TSF) WRF: American Creek Valley	Numerous locations and combinations of locations considered for separate tailings and waste rock facilities. Option MS-77 is the proposed action.
		MS-78	TSF: Anaconda Creek Valley (Single TSF) WRF: American Creek Valley (in WRF) Anaconda Creek Valley (in TSF)	
		MS-79	TSF: Anaconda Creek Valley (Single TSF) WRF: American Creek Valley (2 WRF) Anaconda Creek Valley (in TSF)	
		MS-80	TSF: Lower American Creek Valley (Single TSF) WRF: American Creek Valley (in WRF) ACMA Pit	
		MS-81	TSF: Upper American Creek Valley (Single TSF) WRF: American Creek Valley (in WRF) ACMA Pit	
		MS-82	TSF: American Creek Valley (CIL/POX tailings) Anaconda Creek Valley (Flotation Tailings) WRF: American Creek Valley (in WRF) ACMA Pit	

Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Waste Facilities (TSF and WRF) (continued)	**Alternative Locations (assumes option 76) (continued)**	MS-83	TSF: Anaconda Creek Valley (CIL/POX tailings cell, and flotation tailings in cell in single TSF) WRF: American Creek Valley (in WRF) ACMA Pit	
		MS-84	TSF: American Creek Valley (CIL/POX tailings cell, and flotation tailings in cell in single TSF) WRF: American Creek Valley (in WRF)	
		MS-85	TSF: American Creek Valley (CIL/POX Tailings) Anaconda Creek Valley (Flotation tailings) WRF: American Creek Valley (in WRF) Anaconda Creek Valley (in TSF)	
		MS-86	TSF: American Creek Valley (years 1-5 production) WRF: American Creek Valley (in WRF) Snow Creek Valley (in TSF)	
		MS-87	TSF: Snow Creek Valley (Single TSF) WRF: American Creek Valley	
		MS-88	Decommission and remove all mine infrastructure at closure	Mine infrastructure would be removed when the mine is closed/ decommissioned.
		MS-89	Decommission and dispose on site non-reusable mine infrastructure and equipment	Non-reusable mine infrastructure and vehicles would be disposed of on-site when the mine is closed/ decommissioned. Polluting materials and some reusable materials would be removed from the site.
	Pit Backfill with Solids (Waste Rock)	MS-90	Full Backfill	Pit completely backfilled with waste rock, no pit-lake forms.
		MS-91	Partial Backfill	The proposed action is to partially backfill the pit with waste rock, which would develop a pit-lake.

Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Waste Facilities (TSF and WRF) (continued)	**Pit Backfill with Solids (Waste Rock) (continued)**	MS-92	No Backfill	Pit not filled with any waste rock, results in a pit-lake.
TSF Closure	**Closure Approach**	MS-93	Dry Closure	The facility would be capped in place and sloped to drain.
		MS-94	Wet Closure	Tailings would be covered with ponded surface water.
		MS-95	Close TSF in Place	Tailings would remain in the facility in perpetuity.
		MS-96	Tailings to Pit Closure	Move all tailings to the pit.
		MS-97	Self-buffering Closure	Install a cover system over the TSF that has adequate volume of lime that can be mobilized by infiltrating precipitation thus reducing the potential of acid rock drainage (ARD).
		MS-98	Lined Cover Cap	Install a low permeability (synthetic) liner over the TSF.
		MS-99	Unlined Cover Cap	Install soil cover over the TSF.
		MS-100	Cover Allowing Run-on	Final grading which allows some surface runoff to enter the TSF footprint.
		MS-101	Cover with Full diversion of Run-on	Final grading that does not allow any surface run-off to enter the TSF footprint.
Mine Site Closure	**Surface Re-vegetation**	MS-102	Hard Cover with No Re-vegetation	Create a final cover that includes crushed rock cover to provide erosion protection with minimal or no re-vegetation.
		MS-103	Vegetated Cover	Create a final cover that is vegetated to provide erosion control and habitat.
	Surface Reclamation	MS-104	Land-use Suitable for Human Occupancy	Create a final cover that can support some human function, like recreation, hiking etc.
		MS-105	Hard (coarse rock) cover for WRF and TSF that discourages human and wildlife use	Create a final cover to discourage human or wildlife access to the closed WRF and TSF.

Table C-2: Mine Site Options Considered

Mine Site Subcomponent	Category	Option No.	Mine Site Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Mine Site Closure (continued)	**Post Closure Monitoring and Adaptive Management**	MS-106	Conventional Periodic Monitoring	In this option periodic visits would be paid to the site to sample monitoring wells, observe storm water control structures, vegetation growth, and erosion, allowing adaptive management of the reclaimed areas.
	Post Closure Monitoring and Adaptive Management	MS-107	Remote Sensing Monitoring	In this option periodic site visits would be augmented by the installation of automated sensors, data loggers, telemetry and data transmitting devices as well as satellite imagery. For example, Light Detection and Ranging (LIDAR) technology would be used to provide real time monitoring, allowing adaptive management of the reclaimed areas.

Abbreviations:
ARD = acid rock drainage
CIL = carbon-in-leach
LIDAR = Light Detection and Ranging
LLDPE = linear low-density polyethylene
LNG = liquefied natural gas
PAG = Potentially Acid Generating
POX = Pressure Oxidation
STP = sanitary treatment plant
TSF = Tailings Storage Facility
WTP = Water Treatment Plant

Table C-3: Transportation Facilities Options Considered

Transportation Facilities Subcomponent	Category	Option No.	Transportation Facilities Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Dutch Harbor Cargo and Fuel Terminals	**Supply Line Terminals**	TI-1	Dutch Harbor cargo and fuel terminals)	Two options for cargo and fuel terminals in Dutch Harbor. The proposed action is TI-1.
		TI-2	Dutch Harbor cargo & fuel terminals optional design	
Kuskokwim River Fuel Terminal and Cargo Facility	**Bethel Cargo Facility**	TI-3	Bethel cargo terminal Bethel Location # 1 (Bethel Yard Dock)	Three Bethel locations were considered for cargo terminals, as well as a floating port and a site for a fuel terminal and tank farm. Seven down river locations were also considered as cargo and fuel terminals. The proposed action is TI-3; expand the existing Bethel Yard Dock.
		TI-4	Bethel Location #2 (an undeveloped parcel)	
		TI-5	Bethel Location #3 (an undeveloped parcel)	
		TI-6	Floating Port	
		TI-7	Bethel fuel terminal and tank farm	
	Downriver Options for Bethel	TI-8	Fowler Island	
		TI-9	Johnson Crossing	
		TI-10	Goodnews Bay	
		TI-11	Eek Island	
		TI-12	Security Cove	
		TI-13	Akiachak	
		TI-14	Napakiak	
Freight Transport	**Cargo**	TI-15	Barge transport of 115,000 tons of cargo and supplies per year	Barge and air were evaluated for cargo transport. The proposed action is T-15 and T-16, with the majority of cargo shipped by barge, supported by air transport via a gravel airstrip 9 miles from the mine site.
		TI-16	5,000 feet gravel airstrip, approximately 9 road miles from the mine site	
		TI-17	Use air transport for mining equipment and consumables	
	Diesel	TI-18	Barge transport of 42.3 million gallons per year to mine site	Four options considered for transport of diesel fuel included barge, two types of air transport, and a diesel pipeline. (continued below)

Table C-3: Transportation Facilities Options Considered

Transportation Facilities Subcomponent	Category	Option No.	Transportation Facilities Option	Description
			Proposed Action / Alternatives / Dismissed / Potential Mitigation	
Freight Transport (continued)	**Diesel (continued)**	TI-19	Air transport of diesel fuel with the bulk aviation transport tank	• The proposed action is T-18, barge transport of up to 42.3 million gallons per year. • Alternative 3B considers a diesel pipeline within the pipeline ROW.
		TI-20	Air transport of diesel fuel with a commercial aircraft equipped with fuel storage capabilities	
		TI-21	Build diesel pipeline generally within the pipeline ROW	
	Cargo/Diesel	TI-22	Build railroad from Bethel to the mine site	Several options were considered for transport of a combination of cargo and diesel freight. None of these options are part of the proposed action, but TI-33 is considered as a mitigation measure.
		TI-23	Build road from Bethel to the mine site	
		TI-24	Build road from Dillingham (Nushagak) to the mine site	
		TI-25	Build road from Nenana to the mine site	
		TI-26	Build road from Cook Inlet to the mine site	
		TI-27	Roadless year round transport from Dillingham using rolligons	
		TI-28	Roadless year round transport from Nenana using rolligons	
		TI-29	Roadless year round transport from Cook Inlet using rolligons	
		TI-30	Build ice/snow Road	
		TI-31	Establish winter Snowcat route	
		TI-32	Use hovercraft rather than barges	
		TI-33	Limit barging during key commercial or subsistence fishing periods	

Table C-3: Transportation Facilities Options Considered

Legend (Transportation Facilities Option): Proposed Action | Alternatives | Dismissed | Potential Mitigation

Transportation Facilities Subcomponent	Category	Option No.	Transportation Facilities Option	Description
Barge Traffic/ Angyaruaq (Jungjuk) Port & Mine Access Road	**Alternatives to Kuskokwim Barging**	TI-34	Build road to the Yukon River	Several options to reduce or eliminate barging on the Kuskokwim River were considered. None of these options are part of the proposed action.
		TI-35	Build port on the Yukon River	
		TI-36	Tie into Alaska Department of Transportation (DOT) road to Yukon River	
		TI-37	Build port at end of DOT road on Yukon River	
		TI-38	Upriver barge routing (Yukon)	
		TI-39	Downriver barge routing (Yukon)	
		TI-39a	Establish and maintain a deeper and wide navigation channel between the river mouth and the upriver port	
	Alternative Port and Road Locations	TI-40	Aniak dock location	Options for port and road locations were considered to support freight transport. • The proposed action is TI-44 and 45, which includes port facilities at Angyaruaq (Jungjuk). • Alternative 4 considers TI-42 and 43.
		TI-41	Mine access road from Aniak to mine site	
		TI-42	Birch Tree Crossing dock location	
		TI-43	Mine access road from Birch Tree to mine site	
		TI-44	Angyaruaq (Jungjuk) Port Location: Barge landing, storage areas, 2.8-million-gallon fuel storage tank	
		TI-45	Mine access road from Angyaruaq (Jungjuk) Port to Mine Site	
Angyaruaq (Jungjuk) Port	**Port Design**	TI-46	Sheet Pile design	Eight design options were considered for Angyaruaq (Jungjuk) Port. Sheet pile design is the proposed action, with decommissioning the port when mining ceases.
		TI-47	Rip-rap design	
		TI-48	Use removable floating barge & ramp	
		TI-49	Dredge a deeper floating basin	
		TI-50	Reclaim and decommission port	
		TI-51	Seasonal/ temporary port	

Table C-3: Transportation Facilities Options Considered

Transportation Facilities Subcomponent	Category	Option No.	Transportation Facilities Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Angyaruaq (Jungjuk) Port (continued)	**Port Design (continued)**	TI-52	Move pilings back beyond bank	
		TI-53	Add a second slip to the Angyaruaq (Jungjuk) Port	
Mine Access Road	**Surface/Width**	TI-54	Gravel road	Three surface treatments were considered for the mine access road. The proposed action is TI-54, gravel surface.
		TI-55	"Hi-float" or "Chip Seal"	
		TI-56	Paved	
		TI-56a	Reduce to one lane in wetlands	
	Reclamation	TI-57a	Maintain Angyaruaq (Jungjuk) Port access road to support post-closure monitoring	The proposed action is to maintain the access road into the foreseeable future following mine closure to support long-term monitoring.
		TI-57b	Reclaim and decommission access road	
Airstrip	**Location of Main Airstrip**	TI-58	Build new airstrip along proposed Angyaruaq (Jungjuk) Road	Two airstrip locations were proposed. The proposed action is TI-58, a site approximately 9 miles from the proposed mine site.
		TI-59	Improve Crooked Creek Airfield	
		TI-60	Build road from Crooked Creek to mine site (Related to Option 59)	
	Reclamation of Airstrip	TI-61	Not reclaimed	The proposed action is to maintain the airstrip to support long-term monitoring.
		TI-62	Reclaimed	
Note: Pipeline construction airports and power options relate strongly to the pipeline and mine site components but are covered here because of their similarity to transportation infrastructure options and because scoping comments often grouped comments about power and temporary airstrips with other infrastructure related comments.				
Pipeline Construction Airstrips	**Location of Strips/Types of Strips**	TI-63	Ten airstrips to support construction; six new	Options for air support during the pipeline construction phase. The proposed action is TI-63 and TI-64, which includes use of four existing airstrips and six new airstrips.
		TI-64	Use existing strip at Puntilla Lake	
		TI-65	Improve "Kiska Metals" strip	
		TI-66	Helicopter use	

Table C-3: Transportation Facilities Options Considered

Transportation Facilities Subcomponent	Category	Option No.	Transportation Facilities Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Pipeline Construction Airstrips (continued)	**Reclamation of Temporary Construction, Airstrips and Roads**	TI-67	Temporary airstrips decommissioned to prevent future use; airstrips and roads decommissioned, stabilized, rehabilitated and reclaimed, gravel not returned to material sites	Two options for reclamation of airstrips and roads used during the construction process. TI-67 is the proposed action.
		TI-68	Gravel returned to material site for full restoration of both airstrip and material sites	
Power Plant	**Power Generation Options**	TI-69	Natural gas	Numerous power generation options were considered. • The proposed action is TI-69, with natural gas power generation. • Alternative 3B considers TI-70, with diesel power generation.
		TI-70	Diesel	
		TI-71	Wind	
		TI-72	Nuclear	
		TI-73	Run of river hydropower	
		TI-74	Conventional hydropower	
		TI-75	Conventional biomass	
		TI-76	Waste to Fuel	
		TI-77	Coal	
		TI-78	Peat	
		TI-79	Combine two or more of options 69 through 78	
		TI-80	Natural Gas: Gas-fired electric generation	
		TI-81	Purchase from existing grid	
		TI-82	Purchase from Watana Susitna Hydro-electric (includes transmission line)	
		TI-83	Williamsport Coal Plant	
		TI-84	Bethel Coal Plant	
		TI-85	Beluga Coal Plant	
		TI-86	Nenana Healy Coal Plant	

Table C-3: Transportation Facilities Options Considered

<table>
<tr><th rowspan="2">Transportation Facilities Subcomponent</th><th rowspan="2">Category</th><th rowspan="2">Option No.</th><th colspan="4">Transportation Facilities Option</th><th rowspan="2">Description</th></tr>
<tr><th>Proposed Action</th><th>Alternatives</th><th>Dismissed</th><th>Potential Mitigation</th></tr>
<tr><td rowspan="2">Power Plant (continued)</td><td rowspan="2">Power Generation Options (continued)</td><td>TI-87</td><td colspan="4">Bethel LNG receiving plant with NG pipeline to mine site</td><td rowspan="2"></td></tr>
<tr><td>TI-88</td><td colspan="4">Bethel LNG receiving and power generation plant with transmission lines to mine site</td></tr>
</table>

Abbreviations:
DOT = Alaska Department of Transportation
LNG = liquefied natural gas
ROW = right of way

Table C-4: Pipeline Options Considered

Pipeline Subcomponent	Category		Option No.	Pipeline Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Pipeline Routing/ ROW	Routing	Overall Route	PL-1	Overland natural gas pipeline route through Alaska Range from Cook Inlet through Jones Pass	Seven general pipeline routes and geographic constraints were considered. The proposed action is the overland route through the Alaska Range from Cook Inlet through Jones Pass, with an alignment near existing camps (PL-1, PL-5, and PL-7 for this segment).
			PL-2	Overland natural gas pipeline route from Dillingham (Nushagak)	
			PL-3	Overland natural gas pipeline route from Nenana	
			PL-4	Alternative routes that do not require substantial grading of hillsides for the ROW	
			PL-5	Route with cross-slopes and longitudinal slopes as proposed	
			PL-6	Consider route options near established guide camps to reduce viewshed impacts, e.g., near Windy River	
			PL-7	Route near existing camps as proposed	
		Cook Inlet Route (W to E, S to N)	PL-8	Local route option at Pretty Creek, MP 0 to MP 7	Eight local route options were considered for four segments of the Cook Inlet Route. The proposed action is options PL-8, PL-10, PL-12, and PL-14 for this segment.
			PL-9	Local route option at lower Theodore River, MP 0-MP 5	
			PL-10	Local route option, Little Mt Susitna west, MP 9-MP 29	
			PL-11	Local route option, Little Mt Susitna east, MP 9-MP 29	
			PL-12	Local route option, Theodore River Alternate west, MP 32-MP 49	
			PL-13	Local route option, Theodore River Alternate east, MP 32-MP 49	
			PL-14	Local route options along Skwentna River - north, MP 58-MP 70	

Table C-4: Pipeline Options Considered

Pipeline Subcomponent	Category		Option No.	Pipeline Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Pipeline Routing/ ROW (continued)	**Routing (continued)**	**Cook Inlet Route (W to E, S to N)**	PL-15	Local route options along Skwentna River - south, MP 58-MP 70	
		Alaska Range Route (W to E, S to N)	PL-16	Regional route option through Alaska Range over Merrill Pass	This alignment would differ substantially from the proposed action and would shorten the pipeline length. It would pass through Lake Clark National Park and Preserve.
			PL-17	Local route option on south side Alaska Range via South Round Mountain, MP 95-MP 99	Route options on south side of Alaska Range near Round Mountain. The proposed action is PL-17 for this segment.
			PL-18	Local route option on south side Alaska Range via North Round Mountain, MP 95-MP 98	
			PL-19	Goodman Pass west (Alternate (Alternate Route #1 through Alaska Range)	Route options through Alaska Range via Goodman Pass.
			PL-20	Goodman Pass east (Alternate Route #2 through Alaska Range)	
			PL-21	Egypt Mountain south, MP 141-MP 150	Route options through Alaska Range via Rainy Pass and Dalzell Gorge. PL-22 is under consideration as an action alternative.
			PL-22	Egypt Mountain north, MP 140-MP 149	
			PL-23	Local route option to avoid salt lick 2-3 miles west of Egypt Mountain, ~MP 146-MP 147 on Egypt Mountain north route	
			PL-24	Local route NW of Egypt Mountain, MP J146-J149	Route options through Alaska Range via Jones Pass, MPs J105-J150. The proposed action is PL-24 for this segment.
			PL-25	Local route option further to north away from salt lick 2-3 miles west of Egypt Mountain, closest to Jones variant at MP J147-J148	

Table C-4: Pipeline Options Considered

Pipeline Subcomponent	Category		Option No.	Pipeline Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Pipeline Routing/ ROW (continued)	**Routing (continued)**	**Alaska Range Route (W to E, S to N) (continued)**	PL-26	Regional route option through Alaska Range via Kichatna River valley; route northwest at Skwentna to Kichatna River then west, bypassing 58 miles co-location with Iditarod Trail	Route option to avoid proximity to INHT.
		North Front of Alaska Range (E to W)	PL-27	Regional route from South Fork Kuskokwim to Big River Area; includes St. Johns Hill/Windy Fork south and Big River south	Route options along the north side of the front range, including local route options. The proposed action is PL-27 for this segment.
			PL-28	Local route option, St. Johns Hill/Windy Fork north, MP 155-MP 167	
			PL-29	Local route option, Big River north, MP 187-MP 192	
			PL-30	Move regional route to north along face of Alaska Range, MP 150-MP 194, to avoid important transitional habitat for wildlife and reduce hunting pressure (from improved access), e.g., move route 3 miles to north in Big River area, and at least 2-1/2 miles north and west between Windy and Big River	
		Kuskokwim Hills (E to W)	PL-31	Local route option, Tatlawiksuk River north, MP 213-MP 216	Route options in the vicinity of the Kuskokwim Hills. The proposed action includes PL-31, PL-33, PL-35, and PL-37 for this segment.
			PL-32	Local route option, Tatlawiksuk River south, MP 212-MP 214	
			PL-33	Local route option, Kuskokwim River north, MP 240-MP 242	
			PL-34	Local route option, Kuskokwim River south, MP 239-MP 241	
			PL-35	Three local route options near Moose Creek, MP 256-MP 263: north, north, south	

Table C-4: Pipeline Options Considered

Pipeline Subcomponent	Category		Option No.	Pipeline Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Pipeline Routing/ ROW (continued)	Routing (continued)	Kuskokwim Hills (E to W)	PL-36	Three local route options near Moose Creek, MP 256-MP 263	
			PL-37	Local route option - Kuskokwim Hills north, MP 296-MP 300	
			PL-38	East side E. George River - north, MP 284-MP 287	Local route options - Kuskokwim Hills south, MP 279-MP 308
			PL-39	East side E. George River - south, MP 284-MP 287	
		Width	PL-40	100-feet construction ROW (50-feet temporary workspace + 50-feet permanent ROW)	Alternative right of way widths considered. The proposed action is PL-40.
			PL-41	Alternative that reduces the initial clearing requirements for the majority of the ROW, preferably to less than 50 feet; options to reduce scale of pipeline ROW or eliminate it	
		Grading	PL-42	Construction alternatives that do not require substantial grading of hillsides for the pipeline ROW (see also: minimum tool design option, below)	Grading options considered. The proposed action is PL-43, with season dependent grading.
			PL-43	Season-dependent grading approach to provide level work surface	
		Maintenance Clearing	PL-44	Alternative that does not require clearing of vegetation every 10 years, to preserve early reclamation.	Maintenance clearing options considered. The proposed action is PL-45, with vegetation clearing every 10 years.
			PL-45	Clearing of vegetation every 10 years	
			PL-46	Coordinate with PHMSA to refine clearing requirements in consideration with PHMSA regulations and ecological values	

Table C-4: Pipeline Options Considered

Pipeline Subcomponent	Category		Option No.	Pipeline Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Pipeline Routing/ ROW (continued)	**Routing (continued)**	**BMP methods**	PL-47	Option to install slope breakers and trench breakers at wetland boundaries to prevent trench from draining wetlands	Options for mitigating impacts to wetlands from pipeline trench installation. The proposed action is PL-48, with trench breakers installed as needed, generally not parallel to the trench.
			PL-48	Slope breakers and trench breakers to be installed where needed to avoid draining wetlands	
		O&M Access	PL-49	No permanent road along ROW; potential public access by ATV, snowmachine, walking, or aerial; berms to discourage ATV traffic down ROW	Options for access along the pipeline ROW for maintenance during operations phase. The proposed action is PL-49, with no permanent road along the pipeline corridor.
			PL-50	Permanent dirt road or work pad	
			PL-51	Option to further restrict public access to reduce indirect effects	
Pipeline Design/ Construction	**Off-takes**		PL-52	Facilitate local communities acquiring natural gas supplies from the pipeline	Options considered for off-takes from the natural gas pipeline. The proposed action is PL-53, with no off-takes proposed in current design.
			PL-53	No off-takes in current design; future connection to be determined on case-by-case basis considering technical and economic feasibility	
	Pipe diameter		PL-54	Option to reduce size of pipeline or eliminate it	Options for pipe diameter. The proposed action is PL-55, a 14-inch diameter pipe.
			PL-55	14-inch diameter pipeline, based on power requirements	
	Above/below ground		PL-56	Construct pipeline above ground	Options for above or below ground pipeline construction. The proposed action is PL-57, below ground installation.
			PL-57	Construct pipeline below ground	
			PL-57a	For Alternative 3B – Diesel Pipeline, construct aboveground	
	Trenching		PL-58	For trenching on hillsides, option to use minimum tool concept used in wilderness areas	Options for trenching. The proposed action is PL-59, trenching on hillsides, using excavators, trenchers, and backhoes.
			PL-59	Trenching on hillsides using excavators, trenchers, backhoes	

Table C-4: Pipeline Options Considered

Pipeline Subcomponent	Category		Option No.	Pipeline Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Pipeline Design/ Construction (continued)	**Trench Dewatering**		PL-60	Option requiring dewatering filter bag or geotextile bag when dewatering trench	Options for removing water from the trench. The proposed action is PL-61.
			PL-61	Sedimentation controlled during dewatering with use of sedimentation basins, geofabrics, silt fences, and geotextile filter bags	
	Fuel Type		PL-62	Option considering diesel-fuel pipeline	Options for types of fuel transported by pipeline. • The proposed action is PL-63, natural gas. • Alternative 3B considers PL-62, diesel.
			PL-63	Natural gas pipeline	
	Cathodic Protection at River Crossings		PL-64	Option for impressed current cathodic protection at significant river crossings	Options for cathodic protection. The proposed action is PL-65, with current-passive zinc ribbon installed throughout the length of the pipeline.
			PL-65	Current-passive zinc ribbon system throughout length of pipeline	
	Stream crossing methods/ HDD	**Streams other than Kuskokwim River**	PL-66	Alternate non-disruptive methods (e.g., bridges, aerial, other) for sensitive crossings where HDD would incur high frac-out or scour risk	Options for HDD, under varying stream crossing conditions. The proposed action is PL-68, in close coordination with ADF&G. The state permitting process will also consider HDDs to specific geology and specific drills, plus 'mud management.'
			PL-67	Option for HDD at all fish-bearing streams	
			PL-68	HDD at selected fish-bearing streams; decision for HDD or other crossing methods based on timing windows for trenching; conceptual plans applied on site-specific basis, to be coordinated with ADF&G	
		Kuskokwim River Crossing (HDD)	PL-69	Proposed action would include facilities visible near river banks	HDD Design Options for the Kuskokwim River crossing.
			PL-70	Move visible pipeline components further from the Kuskokwim shore	The proposed action is PL-69, while PL-70 is a potential mitigation measure.

Table C-4: Pipeline Options Considered

Pipeline Subcomponent	Category		Option No.	Pipeline Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Pipeline Design/ Construction (continued)	**Stream crossing methods/ HDD (continued)**	**Kuskokwim River Crossing (HDD) (continued)**	PL-71	Devil's Elbow	Location options for the Kuskokwim River HDD crossing. The proposed action is PL-71, crossing at Devil's Elbow. PL-72 would provide greater set-back distance from a Native Allotment and cemetery site.
			PL-72	Alternative crossing that further avoids Devil's Elbow cemetery	
	Pipeline Test Methods		PL-73	Typically limit hydro testing seasonally	Options for pipeline testing. The proposed action is PL-73, hydro testing. PL-76 would be allowed only in very limited circumstances.
			PL-74	Freeze depressants used if hydro testing is done in winter or shoulder seasons	
			PL-75	Option for air testing	
			PL-76	Option for combination of air and/or hydro testing, to be determined in final design	
	Water Sources		PL-77	Option for trucking water if water sources inadequate	Options for water sources. The proposed action is PL-78, withdrawing water from lakes and streams in the vicinity of the project.
			PL-78	Water withdrawal from lakes and streams	
Aboveground Infrastructure/ Facilities	**Valve Placement**	**Valves (during operations)**	PL-79	Alternative placement of valve stations to avoid visual impacts to local businesses, the Iditarod Trail, hunting/guiding camps and cabins	Options for valve placement and removal. The proposed action is PL-82 and PL-84, valves no further than 20 miles apart, removed at the end of operations.
			PL-80	Option to place valve station close to Rainy Pass Lodge and Kiska Metals	
			PL-81	Additional valves before/after stream crossings	

Table C-4: Pipeline Options Considered

Pipeline Subcomponent	Category		Option No.	Pipeline Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Aboveground Infrastructure/ Facilities (continued)	**Valve Placement (continued)**	**Valves (during operations) (continued)**	PL-82	Valve placement at no more than 20-mile intervals based on safety considerations; 19 block valves total (15 manual + 4 emergency shutdown with associated facilities)	
			PL-83	Increase the number of remote closure valves	
		Valves (post operations)	PL-84	Remove Valves	
	Compressor Station		PL-85	Electrical-powered compressor station	Two fuel options (PL-85 and PL-87) were considered for compressor stations. The proposed action is PL-85, use electric power, and P86, remove facilities at the end of the project.
			PL-86	Dismantle and remove after termination	
			PL-87	Gas-powered compressor station with emissions controls	
	Temporary Gas Storage for Breakage/Repair		PL-88	Option for storage areas to divert pipeline contents in event of breakage	The proposed action is PL-89, temporary storage within the proposed pipeline, isolated at valves. PL-88 is not applicable to a natural gas pipeline; this practice is more applicable to a pipeline containing liquids.
			PL-89	No storage areas proposed; in event of repair/break, isolate at valves and vent, following typical practice	
	Pipeline Security at Aboveground Fault Crossings		PL-90	Fenced and gated at above-ground fault crossings	Two options for security at fault crossings. The proposed action is PL-90, to fence and gate crossings that are above the ground surface.
			PL-91	Option for improved security: buried fault crossings	
	Cook Inlet Landing, Season of Construction		PL-92	Pipe staging to storage yard September-October.	The proposed action would move the pipe from the Anchorage Port to the storage yard at Beluga in September and October. Option PL-93 is being considered as potential mitigation. However, Beluga whales can be present in upper Cook Inlet all year.
			PL-93	Option to time pipe staging to avoid seasonal presence of Beluga whales in critical habitat	

Table C-4: Pipeline Options Considered

Pipeline Subcomponent	Category	Option No.	Pipeline Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Temporary Access Roads/ Camps	**Camps vs. Existing Lodges**	PL-94	Option to house construction workers at existing lodges	Options for temporary lodging for construction employees. The proposed action is PL-95, temporary camps located near the proposed project.
		PL-95	House construction workers in temporary camps: eight 300-person main camps, four 30-person HDD/fly-in camps, and one 60-person camp at compressor station	
		PL-96	Avoid wetlands in the positioning of temporary construction facilities including camps	
	Waste Disposal Methods	PL-97	Waste handled according to applicable regulations; may include open burning or incinerators	Options for waste disposal. The proposed action is PL-97, open burning or incinerators.
		PL-98	Option to use construction camp incinerators	
	Culverts	PL-99	Option to minimize use of culverts and associated fill in flowing waterways	Options for culverts. The proposed action is PL-100, including culvert design based on state requirements.
		PL-100	Culvert design based on ADOT and ADF&G requirements and sized for fish passage if necessary	
	Roads	PL-101	Designed as proposed with untreated gravel surface	The proposed action is PL-101 and PL-103, untreated gravel surface roads, with reclamation.
		PL-102	Use geotextile, “chip seal” “high float” or paving as appropriate to prevent erosion and minimize dust	
		PL-103	Reclaim roads per approved stabilization, rehabilitation and reclamation plans	

Table C-4: Pipeline Options Considered

Pipeline Subcomponent	Category	Option No.	Pipeline Option (Proposed Action / Alternatives / Dismissed / Potential Mitigation)	Description
Material Sites	**Season of Blasting**	PL-104	Production of gravel for access roads, work pads, bedding and padding to be done in season prior to construction, whether winter or summer	Two options for blasting seasons for gravel production for project construction. The proposed action is PL-104, season prior to construction.
		PL-105	Seasonal timing restrictions on blasting	
	Locations	PL-106	Reduce total number of material sites by increasing their size and maximizing haul distance between them	Two options for material site locations. The proposed action is PL-107.
		PL-107	Locations, size and haul distances as proposed	
	Retention & Reclamation	PL-108	Reclaim as required per permit (Contour to surrounding area, scarify and prepare for natural reinvasion)	The proposed action is PL-108 for reclamation. Specific performance measures would be in accord with the mineral material site authorization.
	On the Ground	PL-109	Construct the pipeline to lay on the ground surface	Pipeline would not be buried or elevated; the proposed action is to bury the pipeline.
	Two Pipelines	PL-110	Construct a diesel pipeline parallel to the natural gas pipeline	Pipelines would be buried in parallel trenches.

Abbreviations:
ADF&G = Alaska Department of Fish & Game
ADOT = Alaska Department of Transportation
ATV = all-terrain vehicle
HDD = horizontal directional drilling
INHT = Iditarod National Historic Trail
PHMSA = Pipeline and Hazardous Materials Safety Administration
ROW = right-of-way

Table C-5: Surface Mining and Pits Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-2	Extracting ore by underground mining techniques only (including block caving)	Underground mining could potentially reduce the amount of waste rock generated and reduce surface disturbance.	The gold within the Donlin Gold deposit is not visible to the human eye; it is microscopic and bound within the arsenopyrite (iron arsenic sulfide) and pyrite (iron sulfide) source rock of the deposit. The methods currently proposed are to mine the Donlin Gold deposit using a combination of bulk and selective, open-pit, hard-rock mining techniques. Bulk mining methods are used in massive ore bodies with a relatively homogenous (and lower grade) distribution of gold within the host rock. Selective mining methods would be employed in areas where ore grades are higher or where local geology has produced irregularities in the ore body. Underground mining methods are most suitable when the target is a deeply buried, high-grade ore deposit in a well-defined structure or in veins. This is generally the case when the resource is well characterized and its overall volume is relatively small compared to the surrounding rock mass to be left intact, and the rock strength and hydrologic conditions are favorable. The Donlin Gold project ore body characteristics are not favorable for this method of underground mining. Due to the nature of the resource at the Donlin Gold mine site, this option is technologically and economically infeasible for a combination of reasons including: • A stand-alone underground mine is infeasible because higher grade mineralization, amenable to underground mining, is not contiguous or voluminous enough to justify underground mining over open pit mining. • Some of the resource is relatively shallow and overlying material is not strong enough to safely support underground mining. • Underground mining would be challenging based on variable rock strength conditions and the projected volumes of water inflows that would have to be managed during operations and after closure. Additionally, any method of underground mining would likely also include a closure scenario involving long-term water treatment.

Table C-5: Surface Mining and Pits Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-3	Extracting ore by a combination of surface and underground mining techniques	Partial underground mining could reduce the amount of waste rock generated.	Underground mining is economically infeasible due to the factors described, above, for MS-2.
MS-4	Option for altered pit design: flatten pit walls in order to improve stability	Option was added to assess the effects of flatter/lower slope angles.	If this option were employed to develop the same volume of ore as proposed under the proposed action, it would require a larger pit at the surface, increasing the disturbed area and greatly increasing the amount of waste rock that would be mined and placed in the much larger WRF. If this option were employed with the same surface disturbance, it would greatly reduce the amount of ore that could be mined because the bottom of the pit would not be deep enough to reach much of the ore.
MS-5	Grouting the pit-walls and floor to control pit wall/floor infiltration of groundwater	Controlling flow across the pit wall could reduce groundwater infiltration.	The proposed open pit(s) will have several thousand acres of exposed rock surface and will be excavated far into the water table. Grouting the pit walls would not be possible on any active pit faces or the floor until mining in that area was complete. This would allow large quantities of groundwater to enter the pit, requiring pumping and likely weakening the pit walls. The pressure of groundwater against any grouted surface would be very large and likely to fail frequently, requiring substantial effort to repair leaks.
MS-7	Allowing surface-water runoff to enter the pit	The pit could serve as a sedimentation basin.	Allowing surface water runoff to flow down the sidewalls of the pit would compromise the stability of the pit. All surface water that would accumulate would need to be removed by pumping. Water quality concerns would be mitigated better by the American Creek contact water dams proposed under Alternative 2.
MS-9	Use of only diesel shovels as loading equipment at the mine site	Diesel shovels are often used to load ore and would reduce the electrical power demand.	The proposed action is to use a mixed fleet of electric and diesel shovels; this option to use seven diesel shovels would increase consumption of diesel fuel and associated barging. There is no environmental benefit compared to the proposed action.
MS-11	Use of a trolley-assist system as hauling equipment at the mine site	Trolley-assisted haul trucks could use electric power and infrastructure to assist in the transport of ore and waste rock up pit ramps, reducing the need for diesel fuel for mine trucks.	The pit layout and constantly changing haul ramp locations cause this option to be technically infeasible.

Table C-5: Surface Mining and Pits Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-12	Use of a conveyor system as hauling equipment at the mine site	Conveyors could be used for hauling ore from the pit also reducing the need for diesel-powered trucks.	Conveyors would need to be moved frequently as the pits deepen, requiring significant effort to disassemble and re-assemble during which the conveyors would be down and production would be reduced.

Abbreviations:
MS = mine site
WRF = waste rock facility

Table C-6: Ore Processing Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-15	Processing ore by heap leaching. In the heap leaching process, gold is extracted by direct cyanidation of crushed ore placed on a lined pad where the gold-containing solution is percolated through the heap by gravity flow and is collected and further processed to create a final doré product.	This approach would replace proposed ore processing scenario and potentially simplify closure and reclamation activities associated with some of the subcomponents.	Pretreatment requires reducing the ore particles to fine size. Pretreatment would not be possible for the coarse ore size fed to a heap leach process resulting in economically infeasibility. Size reduction and pretreatment would results in particles too fine to be placed on a heap as the heap would be geotechnically unstable and leach solutions could not percolate through the heap to extract gold.
MS-17	Off-site concentration - flotation concentrate could be transported offsite and further processed to recover gold.	Moving the processing of concentrate off-site could reduce potential local impacts of ore processing.	This option would require shipping large volumes of concentrate off-site; potentially several thousand cubic yards per day. The volumes to be transported would exceed the capacity of the proposed transportation infrastructure component even with increased barge trips because the system is limited to the ice-free barging season. Concentrated ore would need to be stockpiled during the eight months when barging cannot occur and would require a very large storage area.

Table C-6: Ore Processing Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-20	On-site processing by roasting - In the roasting process, ground ore is oxidized to convert sulfide mineralization to oxides, which are more suitable for carbon-in-leach (CIL) extraction.	Roasting would replace pressure oxidation of whole or concentrated ores.	Roasting is technologically infeasible due to the nature of the resource. Roasting is advantageous when there is a high organic carbon content in the ore that would interfere with cyanide leaching. That is not the case with the resource at the proposed project site.
MS-21	On-site biological oxidation - This option uses microorganisms to oxidize sulfides in the concentrated ore, allowing gold to be more efficiently removed during the CIL process.	Biological oxidation would replace pressure oxidation of whole or concentrated ores.	This option would be technically infeasible. Biological oxidation is not a mature technology. It requires consistent ore characteristics. Mining would present distinctly variable ore quality to the processing plant. Crucially, moderate-temperature oxidizing conditions must be narrowly controlled to avoid damaging or killing the fragile microbes and hampering pretreatment. Site conditions vary seasonally and would present significant challenges to maintaining efficient biological oxidation.
MS-22	Using whole ore instead of concentrate in the pressure oxidation (POX) process	Using the POX process on whole ore would save a step in the ore processing procedure and could reduce local impacts.	This would be technologically and economically infeasible for this project because of the nature of the resource. The low sulfur grade of the ore would mean that whole ore autoclaving would not be autothermal and the footprint for the processing circuit would be larger and operating costs higher compared to the proposed action.

Table C-6: Ore Processing Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-25	Use of thiosulfate for chemical extraction -This technology uses calcium thiosulfate (with the addition of ammonia and cupric ion) to extract gold.	The use of thiosulfate is an option to using cyanide extraction and would remove or reduce impacts related to cyanide.	Thiosulfate leaching is a process that removes gold from ore without the use of cyanide. Perceived advantages of the thiosulfate leaching process include the lower toxicity of thiosulfate relative to cyanide, and lack of interference from certain materials, such as refractory sulfides, that are known to impede the cyanide leaching process. The Donlin Gold project would not realize these advantages because the mineralization at the mine site contains relatively low levels of refractory sulfides. In addition, the substantial quantities of carbonates and bicarbonates present in the ore at the proposed mine site would cause excessive oxidation of the thiosulfate reagent, resulting in increased thiosulfate reagent consumption and much higher costs for thiosulfate leaching compared to cyanide. The need to transport and use much greater quantities would offset any potential benefit achieved due to the lower toxicity of thiosulfate relative to cyanide. Another consideration is clay mineralogy. Based on the existence of sedimentary deposits and local geology there are at least some illite and kaolinite present in the ore at the proposed mine site. Thiosulfate leaching must be performed in a basic solution (pH greater than 9) (Aylmore 2001). At this pH, any clay particles existing in the system would be dispersed, thereby increasing the viscosity, and decreasing the recovery of gold from thiosulfate leach solutions. *The complications of using thiosulfate at the proposed Donlin Gold project mine site to recover gold make it infeasible as a substitute for cyanide leaching.*
MS-26	Use of thiourea for chemical extraction	The use of thiourea is an option to using cyanide extraction and would remove or reduce impacts related to cyanide.	Thiourea's lower toxicity and greater rate of gold dissolution may be perceived as advantages compared to cyanide. However, thiourea still has the potential to be highly toxic, and would need to be used (and transported) in much greater quantities compared to cyanide. Thus any benefit achieved due to decreased toxicity compared to cyanide would likely be offset by the need to use much greater quantities of thiourea compared to cyanide.

Table C-6: Ore Processing Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-26 (cont'd)	Use of thiourea for chemical extraction (cont'd)	The use of thiourea is an option to using cyanide extraction and would remove or reduce impacts related to cyanide (cont'd).	The principal reason why thiourea leaching is not feasible involves the degradation of the reagent. Oxidation of thiourea not only leads to loss of reagent but also the formation of elemental sulfur, which covers the gold particles and prevents leaching. For this reason, extremely close control of solution pH and oxidation potential would be required through all stages of the leaching process. Thiourea consumptions of 1 to 4 kilograms per ton have been projected for optimized thiourea leaching systems, although rates as high as 10 to 12 kilograms per ton are likely in large-scale real-world applications. Such high consumption rates, combined with the need for additional reagents and process control considerations would make the overall cost of the thiourea process very high, probably at least twice that of conventional extraction using cyanide. Although thiourea leaching has been demonstrated in numerous experiments and small-scale programs, there are no known examples of commercially successful operations that use thiourea leaching as the main gold extraction technique from lode gold resources.
MS-27	Use of bromine for chemical extraction	The use of bromine is an option to using cyanide extraction and would remove or reduce impacts related to cyanide.	This option is technologically infeasible for this project. Bromine is an antiquated technology for extracting gold and is extremely hazardous. The use of bromine would increase potential environmental and safety risks compared to the proposed action.
MS-28	Combination of cyanide and other extracting chemicals	The intent of this option is to reduce overall cyanide usage.	This option is technologically infeasible for this project. The successful use of a combination of chemicals to extract gold has never been demonstrated as economically feasible.
MS-29	Locate processing plant on Lower American Ridge	Evaluated to optimize material movement, logistics, and environmental benefit.	While technically and economically feasible, this option is unlikely to reduce impacts compared to the proposed action.

Abbreviations:
CIL = carbon-in-leach
MS = mine site
POX = pressure oxidation

Table C-7: Throughput Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-31	20,000 tons of ore per day	Different throughputs could change impacts.	MS-32 - 30,000 tons per day is not economically feasible as explained below; therefore, 20,000 tons per day is also not feasible.
MS-32	30,000 tons of ore per day	A reduced rate of throughput could address social impacts of the boom and bust cycle for a large project. A lower peak of activity at start up and a longer period of employment in the region may reduce social impact of rapid population growth followed by decline at closure.	At the proposed rate of 30,000 tons per day (versus the 59,000 tons per day Proposed Action), it would not be economically feasible to build the natural gas pipeline and a significant increase in barging of diesel fuel would be required to fuel the mine site power plant. Key environment effects would be elimination of the natural gas pipeline footprint, offset by increased barge traffic on the Kuskokwim River and increased air emissions from diesel generators. Donlin Gold prepared technical memos regarding environmental effects (Donlin Gold 10-30-2013) and the economics of constructing a natural gas pipeline (Donlin Gold, 1-29-2014). These memos were independently reviewed by contractors working for the Corps (URS 1-6-2014, NEI 2-3-2014). The Corps concluded that at the lower rate of throughput, investors would not fund the large cost of construction of the natural gas pipeline. The reduced throughput results in relatively higher capital and operating costs, compared on a per unit basis to the proposed action (Alternative 2), and coupled with lower annual revenues this would likely result in a marginal if not uneconomic project Without the natural gas pipeline, the combined diesel volume for this option would be 65 to 70 Mgal per year; a 70% increase over Alternative 2. While there would be some reduction of consumables under this option, the additional diesel volumes would result in a net increase in annual barging.
MS-34	75,000 tons of ore per day	Different throughputs could change impacts.	Although this option would shorten the period during which active mining occurred, it would increase the intensity of transportation effects compared to the 59,000 tons per day Proposed Action.
MS-35	100,000 tons per day	Different throughputs could change impacts.	Although this option would shorten the period during which active mining occurred, it would increase the intensity of transportation effects compared to the 59,000 tons per day Proposed Action.

Abbreviations:
Mgal = million gallons
MS = mine site

Table C-8: Water Treatment Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-37	Reducing length, number and vulnerability of process pipelines (design mitigation)	Reducing the length and number of pipelines, decreasing vulnerability through materials, placement, protection, and maintenance of pipelines could reduce impacts.	The design engineers will carefully assess pipeline vulnerability to ensure maximum reliability of the processing plant. It will be in Donlin Gold's best interest to properly design and maintain a reliable plant. Any vulnerability is best assessed and mitigated later in the design process.
MS-39	Water Treatment: Increase tank capacity by 50%	Options MS-39 and MS-40 were suggested by the EIS team as ways of handling unexpected increases in volume, and reducing impacts to local surface waters.	The design of the WTPs is very conceptual at this time, and the evaluation of tank size needs to occur during final design. As defined, the option is potential engineering mitigation to be considered in final design, not an alternative.
MS-40	Water Treatment: Increase pumping capacity by 50%	Options MS-39 and MS-40 were suggested by the EIS team as ways of handling fluctuations in volume, and reducing impacts to local surface waters.	The design of the WTPs is very conceptual at this time and the evaluation of pumping capacity needs to occur during final design. As defined, the option is potential engineering mitigation to be considered in final design, not an alternative.
MS-41	Water Treatment: Add backup power supply	Option MS-41 was suggested by the EIS team as a way of increasing reliability.	Further analysis determined backup power not needed due to proposed freeboard and monitoring interval proposed.
MS-42	Zero discharge - All waste water would be kept on site	This option could reduce impacts to local surface waters.	This option would require containment of proposed discharges including water from the pit dewatering wells. Because the proposed project has a projected water surplus, large containment structures (i.e., reservoirs) would be needed to contain the water until it was used as process water or evaporated. This option would further reduce impacts to the base flow in Crooked Creek because under the proposed action, water from the dewatering wells would be discharged after treatment to the creek. This option adds the risk that if more water is produced than is predicted, there could be unpermitted discharges.
MS-43	Treatment and Discharge of Pit Dewatering and Storage/Use/Re-use of Process and Contact Water	Avoids discharging contact water.	This option was Donlin Gold's proposed action. Donlin Gold subsequently analyzed at agency request using an advanced water treatment method to treat and discharge some contact water. This is now Donlin Gold's proposed action. The AWT method reduces the amount of water stored in the TSF; thereby reducing the potential for releases.

Table C-8: Water Treatment Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-44	Treatment and Discharge of all Water	Would avoid onsite water storage during operations	Water storage is required to ensure consistent supply for milling. Water storage also allows reuse of contact water and prevents the need to constantly supply freshwater from other sources; thereby reducing the quantity consumed.
MS-45a	Alternatives to the Octolig columns for treatment for selenium	Selenium is difficult to treat in wastewater	Upon completion of mining approximately 30 years from now, the mine pit would begin to fill with runoff and groundwater. Models predict that approximately 50 to 55 years after closure, the pit would be nearly full and would be pumped and treated to prevent untreated water flowing from the pit. Donlin Gold proposes to treat pit discharge water using the high density sludge method and polish with Octolig columns to treat selenium. Donlin Gold has conducted laboratory scale tests that demonstrate Octolig columns can be effective and can achieve selenium concentrations of less than 0.001 mg/L. They have also evaluated ion exchange, reverse osmosis, and activated carbon, and all are effective in removing selenium (SGS CEMI 2008). It is impossible to know what methods will exist in approximately 80 years to treat selenium in wastewater. It is also possible that feasibility issues that exist today with other technologies could be resolved in the next 80 years. Donlin Gold has demonstrated that technology exists to successfully meet the current discharge limit of 0.005 mg/L, so developing alternatives at this time for an activity so far in the future does not appear worthwhile. Additionally, the future discharge will be subject to permitting requirements to ensure discharges meet the discharge limits in place at that time. Analysis of various alternatives to treat selenium and other constituents would be conducted as part of that permitting effort.

Abbreviations:
AWT = advanced water treatment
EIS = environmental impact statement
mg/L = milligrams per liter
MS = mine site
TSF = tailings storage facility
WTP = water treatment plant

Table C-9: Mercury and Cyanide Handling Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-50	On-site mercury disposal - A small hazardous waste landfill would be built and permitted on site for mercury-containing wastes.	On-site mercury disposal would reduce risks and impacts associated with transporting the waste.	Under the 2008 US Export Ban, the preferred long term disposal method is shipment to a Department of Energy (DOE) Disposal Facility, currently tied up due to funding and siting problems. Donlin Gold would ship all mercury co-product to a federally-regulated storage facility in the U.S. authorized by DOE to accept mercury while awaiting construction of the permanent DOE facilities.
MS-51	On-site mercury recycling - A mercury recovery/refining/ recycling facility would be built on-site to recover mercury from mercury-loaded carbon.	On-site mercury recovery would reduce the volume of mercury waste product shipped offsite.	Donlin is proposing a mercury abatement system which would result in capture of liquid mercury co-product and mercury-loaded carbon. Further recovery of mercury from the carbon may require Donlin to be permitted as a Hazardous Waste Treatment, Storage, and Disposal Facility under RCRA. While this option would decrease the overall volume of mercury containing waste shipped offsite, the amount of mercury transported would not change. There is no apparent environmental advantage to this option.
MS-53	Air transport of mercury to federally regulated storage facility	Air transport would reduce the risk of mercury spills in Kuskokwim River watershed.	Air transport of mercury is limited to 77 pounds per shipment and 76 pound containers are commercially available for elemental mercury. Donlin Gold estimates the mine would remove approximately 22,000 pounds per year of mercury from the gaseous waste streams. At 76 pounds per shipment, it would require 290 individual containers (packages) to transport this amount of mercury. This number of air shipments is not practical.
MS-54	Off-site mercury recycling facility	Suggested to recover elemental mercury and allow reuse of activated carbon.	The mercury-loaded carbon would be placed into long-term storage in a regulated mercury storage facility outside Alaska. It is not feasible to recover the mercury from the activated carbon.
MS-56	Cyanide neutralization using Cyanochlor	Use of neutralization agent might lessen cyanide toxicity.	This option is technologically infeasible because the use of Cyanochlor in mining operations at this scale and size is unproven.
MS-57	On-site segregation and disposal of cyanide-containing waste	Segregating tailings containing spent cyanide might allow reduction of risk for environmental impacts from long-term storage of tailings.	The proposed action would neutralize the CIL/POX tailings exiting the autoclave by combining with the flotation tailings. Under a segregated option, calcareous sandstone would need to be added to neutralize the CIL/POX tailings, requiring a new onsite mine or transport to the mine by river barge and increasing the overall volume of tailings by 25%. It is estimated the cargo barge traffic would be at least double that of the proposed action. The footprint of the tailings facility would be increased by 550 acres over the proposed action. The option was dismissed because it presented operational disadvantages and increased environmental impact.

Abbreviations:
CIL = carbon-in-leach
DOE = Department of Energy
MS = mine site
POX = pressure oxidation
RCRA = Resource Conservation and Recovery Act

Table C-10: TSF and WRF Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-58	Tailings Storage: Segregated	Segregated tailings disposal is used in some mining operations and was considered to determine if it presented any benefit.	Donlin Gold proposes to neutralize the carbon-in-leach/pressure oxidation (CIL/POX) tailings by combining them with the flotation tailings. Under MS-58, the CIL/POX tailings would need to be neutralized using calcareous sandstone (CSS). CSS could be mined within the footprint of the WRF; however, adding the CSS to the tailings would increase the size of the ultimate tailings facility by 450 acres. This option would be operationally more complex and presents no environmental advantage.
MS-60	Neutralize potentially acid-generating (PAG) waste rock by placing in the TSF.	Reduce the concern for acid generation or mineral leaching from the waste rock facility.	The option would place the PAG 6 waste rock in the TSF. Placing the material would be difficult because equipment could not operate on the wet tailings pond surface. This would be especially difficult in the winter. There is also concern that pushing the waste rock material in from the edge of the tailings pond could compromise the liner. This option would also result in long-term storage of PAG material in the Anaconda Creek valley which is not proposed by Donlin Gold. This increases the long-term environmental risk.
MS-60a	Neutralize PAG waste rock by placing in the completed pit.	Reduce the concern for acid generation or mineral leaching from the waste rock facility.	Under this option, all PAG 6 waste rock would ultimately be placed in the completed pit where it would remain submerged in the pit lake into perpetuity. Under Alternative 2, Donlin proposes building the WRF hydrogeologically upgradient of the open pit. Following mine closure, seepage from the WRF would flow to the open pit and mingle with groundwater recharge. When the pit is nearly filled, water would be pumped from the top of the pit lake, treated, and discharged under an Alaska Pollutant Discharge Elimination System (APDES) permit. It is anticipated that the lake will stratify, with high total dissolved solids (TDS) water in the bottom of the lake with an overlying lower TDS layer. The upper layer will be easier to treat, and additional high TDS water flowing to the lake will assist with maintaining the stratification. Donlin Gold's plan under Alternative 2 to place the PAG 6 in isolated cells should be adequate to prevent the material from generating acid. However, if the PAG 6 cells were to generate acid and acidic seepage reached the pit lake, the high TDS content of the seepage provides an environmental benefit in that it would help maintain the pit lake stratification. Adding PAG 6 material to the pit under Alternative 5C would reduce acid generation from this material once it is covered with lake water, but at the expense of a potentially less stratified lake. (continued below)

Table C-10: TSF and WRF Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-60a (continued)	Neutralize PAG waste rock by placing in the completed pit.	Reduce the concern for acid generation or mineral leaching from the waste rock facility.	The option would introduce additional barging and air quality impacts, and water quality challenges during operations and closure. Therefore, the additional cost and logistical challenges are unwarranted. Note that this option was carried forward for detailed analysis as Alternative 5C. Conceptual engineering was then conducted to develop the concept sufficiently for impact analysis in the EIS and that work showed that the option was infeasible.
MS-61	Chemical management at the TSF to segregate arsenic-containing tailings for separate handling - In this option the tailings stream would be chemically segregated and the arsenic containing portion would be disposed of separately.	This option would reduce the amount of arsenic-contaminated waste generated.	Tailings are uniform in their physical and chemical composition, since they emerge from the mill in slurry, thoroughly mixed through pump stations. Separation of any individual chemical constituent is not technically or economically feasible.
MS-62	Chemical management at the TSF, treating tailings stream with a buffering agent (lime) and/or stabilizing agents (fly-ash, cement).	This option would reduce the acid-generating capacity of the waste.	This option is economically infeasible due to the transportation logistics of getting required chemicals to the mine site-- on the order 2,000 to 5,000 tons per day. Moving this volume of additives would increase barging and add extraordinary costs as well as creating further environmental impacts.
MS-64	Paste (Thickened) Tailings	Paste tailings disposal is used in some mining operations and was considered to determine if it presented any benefit.	Paste tailings are commonly used as backfill for underground mines but surface application of paste tailings is much less common. There are no other mines operating at a similar scale or climactic conditions using surface paste tailings disposal. Winter operations could cause freezing of the tailings in the pumps and pipelines and frozen tailings mounds are likely to build under spigots. This will require frequent abandonment or moving of spigots which would be expensive and reduce production due to down time. While the option would reduce the TSF footprint by 150 acres, it was dismissed because it is operationally complex and unproven at this scale.
MS-66	Unlined TSF - In this option, only the dam wall of the TSF would be lined.	An unlined facility is easier to construct and manage.	This does not present any environmental benefit compared to the proposed action.

Table C-10: TSF and WRF Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-68	Double-lined TSF	Option was considered to reduce potential for tailings dam leakage.	The proposed 60-mil liner is considered industry best management practice. Potential for leakage is assessed in the EIS and mitigation to collect any leakage in the form of the Seepage Recovery System and monitoring has been proposed by Donlin Gold.
MS-69	High-performance liner	Using XR5 or BGM could increase resistance against leakage.	linear low-density polyethylene (LLDPE) has been selected as an appropriate liner type.
MS-69a	TSF liner design of a prepared surface topped with a layer of clay, overlain by a permeable layer to provide leak detection, topped with a synthetic liner	Option to improve the TSF liner performance.	The proposed TSF design includes a seepage recovery system that is intended to intercept any seepage through the LLDPE synthetic liner. A clay liner overlain by a permeable layer, topped with a synthetic liner does not add any additional benefit to the existing TSF design. Clay overlain by a drainage blanket topped with a synthetic liner is a typical landfill or heap leach pad design, but is not at all common in tailings facility designs. Furthermore, a drainage layer would unnecessarily complicate construction, without any notable benefit. Finally, there are no locally-available sources of suitable clay, and placement and compaction of a clay liner in a cold climate such as Donlin would be challenging.
MS-71	Secondary dam downstream from TSF	Option was considered to offer a means of capturing material that might escape through spills or cracks in the TSF dam.	In the current state-of practice there is every scientific, engineering and construction technique available to design a dam wall that will function properly. The dam will be built in downstream lifts, and if the starter dam shows the slightest sign of non-performance, the future lifts can be adjusted to restore performance. With the cascading option there is little opportunity to go back to increase the dam wall, so the footprint of the entire facility would be larger, leading to greater overall environmental impact. A larger footprint would also collect more precipitation leading to greater need for operating water volume storage or treatment needs.
MS-72	Designing the TSF with multiple cells in an upstream to downstream sequence	Multiple cells could provide downstream protection and capture of spills.	Technological and economic challenges make this option infeasible. Please see the note for MS-71; it applies to this option as well.
MS-73	Flattening TSF side slopes	This design could increase stability of dam wall.	During final design and prior to construction, the tailings dam design will be subject to a Failure Modes Effects Assessment required by the State of Alaska Dam Permitting process. (An early stage FMEA was conducted to inform the NEPA process but would be recompleted during the dam design and permitting phase.) If design deficiencies are discovered during the FMEA, the dam design would be revised to mitigate those concerns.

Table C-10: TSF and WRF Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-74	Improvement of TSF foundation soils	Suggested by the EIS team to ensure full consideration of possible options.	The proposed action is to strip the soils to bedrock before constructing the TSF. Soil stability would not be a problem with a bedrock "foundation" so this option would not be applicable.
MS-75	Comingled WRF & TSF	A single facility would reduce the overall footprint and simplify closure.	The comingled option presents potential environmental benefits particularly for wetlands fill reduction and potentially a long-term reduction in water quality impacts to Anaconda Creek. However, the option requires extraordinary additional material handling at a very high cost. There could also be increased downtime that could result from a more complicated process. While there may be some environmental benefits for wetlands and perhaps for water quality, there would be other increased impacts. The most important of these impacts would be increased fuel consumption and the resulting increased tailpipe emissions, carbon footprint, barging, and fugitive dust. The comingled alternative also comes with the tradeoff of significant feasibility issues, such as geotechnical stability risk of the WRF and operational reliability. This option concept is relatively new and unproven at this scale and in the sub-arctic. Note that this option was carried forward for detailed analysis as Alternative 5B. Conceptual engineering was then conducted to develop the concept sufficiently for impact analysis in the EIS and that work showed that the option was infeasible primarily for cost but also because of other increased impacts.
MS-75a	Blend PAG 6 into the WRF instead of placing in isolated PAG 6 cells.	Blending PAG may reduce the potential for it to generate acid rock drainage (ARD).	Past experience with conditions necessary for successful blending of highly reactive PAG rock with NAG rock indicates that, in order to fully mitigate both mineral leaching and ARD concerns, the NAG-PAG blend must be extremely fine (centimeters scale), which is impractical at the proposed project scale. There is a trade-off between blending to eliminate ARD, and the risk that the entire rock mass will become acidic. There are no precedents for successfully blending PAG 6-type rock. With a low permeability cap and NAG rock foundation, the PAG 6 cells are designed to slow down, but not necessarily eliminate all, infiltration and ARD from the cells. Redundant systems to prevent discharge of PAG 6 drainage to the environment include collection and mixing with higher quality WRF drainage, capture in the lower CWD during operations, and reuse as process water in the mill. During post-closure, this drainage will collect and be managed in the pit lake, which will have a treated discharge that is required to meet APDES permit limits.

Table C-10: TSF and WRF Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-75b	Install a liner under the WRF	Could potential help manage seepage from WRF	There is no environmental benefit from installing a liner under the WRF. During closure, mine contact water from the tailings storage facility and the contact water dams will be pumped to the open pit and groundwater will be allowed to fill the pit. When the pit is nearly filled, water will be pumped from the top of the pit lake, treated, and discharged under an APDES permit. It is anticipated that the lake will stratify, with high TDS water in the bottom of the lake with an overlying lower TDS layer. The upper layer will be easier to treat, and additional high TDS water added to the lake will assist with maintaining the stratification. With a liner, runoff and seepage from the WRF would need to be directed to the pit lake for storage and to contribute to the deeper high TDS layer. Without a liner, seepage percolating through overburden and shallow bedrock would flow with groundwater to the pit lake because the WRF would be upgradient of the pit. Under either a lined or unlined scenario, the result is the same; all WRF contact water would be directed to the pit.
MS-75c	Use of a high permeability layer underneath the soil layer could also help minimize the amount of water infiltrating the waste rock	Could improve the performance of the WRF cover	The proposed WRF design includes a low permeability layer to limit infiltration, and a drainage design to promote runoff. The WRF cover design was developed to use native materials stripped from the WRF footprint supplemented by overburden materials (colluvium and terrace gravels) from development of the open pit. The final top layer of peat mineral mix is a growth medium layer, intended to facilitate vegetation growth. The terrace gravel and colluvium layer is a low permeability layer in place to limit infiltration. Contouring of the WRF dump face will produce a natural drainage pattern of secondary drainage channels and swales to help promote runoff. The vegetation is further expected to intercept a large portion of the water, and to facilitate evapotranspiration. Water that does actually infiltrate the WRF will largely be collected into the network of large rock drains that will be constructed at the base of all main drainages and secondary drainages of the pre-construction topographic surface within the footprint of the WRF. These drains will collect the infiltrated water and direct it to the Contact Water Dam during operations, and to the pit lake following closure. Incorporating a high-permeability layer, such as a sand layer, would not significantly improve the reduction of infiltration. In addition, sufficient quantities of a suitable granular material that could function in this capacity are not available in the project area.

Abbreviations:
APDES = Alaska Pollutant Discharge Elimination System
ARD = acid rock drainage
BGM = bituminous geomembrane liner
CIL/POX = carbon-in-leach/pressure oxidation
CSS = Calcareous sandstone
CWD = contact water dam
EIS = environmental impact statement
FMEA = failure mode effects analysis
LLDPE = linear low-density polyethylene
MS = mine site
NEPA = National Environmental Policy Act
PAG = potentially acid-generating
TDS = total dissolved solids
TSF = tailings storage facility
XR5 = type of geomembrane liner
WRF = waste rock facility

Table C-11: TSF Locations Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-78	TSF: Anaconda Creek Valley (Single TSF) WRF: American Creek Valley (in WRF), Anaconda Creek Valley (in TSF)	Different locations for the TSF and WRF were evaluated for potential effects.	Option is feasible but does not reduce potential environmental impacts compared to the proposed action.
MS-79	TSF: Anaconda Creek Valley (Single TSF) WRF: American Creek Valley (2 WRF), Anaconda Creek Valley (in TSF)	Different locations for the TSF and WRF were evaluated for potential effects.	Option is feasible but does not reduce environmental impacts compared to the proposed action.
MS-80	TSF: Lower American Creek Valley (Single TSF) WRF: American Creek Valley (in WRF), ACMA Pit	Different locations for the TSF and WRF were evaluated for potential effects.	This is technologically infeasible due to insufficient volume in the valley to provide adequate storage capacity in American Creek Valley.
MS-81	TSF: Upper American Creek Valley (Single TSF) WRF: American Creek Valley (in WRF) ACMA Pit	Different locations for the TSF and WRF were evaluated for potential effects.	This is technologically infeasible due to insufficient volume to provide adequate storage capacity in American Creek Valley.
MS-82	TSF: American Creek Valley (CIL/POX tailings), Anaconda Creek Valley (Flotation Tailings) WRF: American Creek Valley (in WRF) ACMA Pit	Different locations for the TSF and WRF were evaluated for potential effects.	Option is feasible but does not reduce environmental impacts compared to the proposed action.
MS-83	TSF: Anaconda Creek Valley (CIL/POX tailings cell, and flotation tailings in cell in single TSF) WRF: American Creek Valley (in WRF) ACMA Pit	Different locations for the TSF and WRF were evaluated for potential effects.	Option is feasible but does not reduce environmental impacts compared to the proposed action.

Table C-11: TSF Locations Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-84	TSF: American Creek Valley (CIL/POX tailings cell, and flotation tailings in cell in single TSF) WRF: American Creek Valley (in WRF)	Different locations for the TSF and WRF were evaluated for potential effects.	Option is feasible but does not lessen environmental impacts as compared to the proposed action.
MS-85	TSF: American Creek Valley (CIL/POX tailings), Anaconda Creek Valley (flotation tailings) WRF: American Creek Valley (in WRF), Anaconda Creek Valley (in TSF)	Different locations for the TSF and WRF were evaluated for potential effects.	Option is feasible but does not lessen environmental impacts as compared to the proposed action.
MS-86	TSF: American Creek Valley (years 1-5 production) WRF: American Creek Valley (in WRF), Snow Creek Valley (in TSF)	Different locations for the TSF and WRF were evaluated for potential effects.	This is technologically infeasible due to insufficient area to provide adequate storage capacity.
MS-87	TSF: Snow Creek Valley (Single TSF) WRF: American Creek Valley	Different locations for the TSF and WRF were evaluated.	This is technologically infeasible due to insufficient area in Snow Creek Valley to provide adequate storage capacity.

Abbreviations:
ACMA = American Creek magnetic anomaly
CIL/POX = carbon in leach/pressure oxidation
MS = mine site
TSF = tailings storage facility
WRF = waste rock facility

Table C-12: Surface Mining and Pit Closure Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-88	Decommission and remove all mine infrastructure at closure.	Leaving certain materials onsite could cause groundwater or other pollution concerns.	The proposed action would dispose of much material on-site. Any material disposed onsite would be subject to permitting approval by ADEC. Some off-site transport would support salvage and reuse, which is viewed as environmentally beneficial. Trucking and barging inert waste material to offsite landfills would be expensive, consume fuel, increase barging, and would provide little environmental benefit. Some infrastructure is required to provide access for the long-term water treatment and monitoring so the *"decommission ALL mine infrastructure…"* aspect was eliminated as too sweeping.
MS-90	Decommissioning pit with full pit backfill - The pit would be completely backfilled with waste rock, and no pit-lake would form.	A pit lake would not form and the size of the waste rock facility would be reduced.	This option is economically infeasible because of the cost to load and backhaul the millions of tons of rock that would be needed from the waste rock facility (WRF). It would also require many years to move the rock, delaying closure and reclamation of the WRF.
MS-92	Decommissioning pit without any backfill - The pit would not be filled with waste rock at all, causing it to fill with water and create a larger pit-lake than Alternative 2.	Impacts could be reduced because more groundwater from the mine area would be captured in the pit.	This does not reduce impacts compared to the proposed action, which includes partial backfill. It would require alternative management of PAG 7 and would increase WRF size.

Abbreviations:
ADEC = Alaska Department of Environmental Conservation
MS = mine site
PAG = potentially acid-generating
WRF = waste rock facility

Table C-13: TSF Closure Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-94	Use of wet closure for the TSF	This option was considered as an alternative to dry closure of the TSF.	This option does not reduce impacts and introduces dam safety risks compared to the proposed action. It would require long term management of TSF water.
MS-96	Closure of TSF by moving all tailings to the pit	Would eliminate some impacts associated with storage of tailings.	This option may be technologically feasible, but it would be impractical and cost-prohibitive to excavate and backhaul tailings to the pit. The excavating and hauling would have some environmental impacts associated with equipment emissions and diesel consumption. It would not substantially reduce environmental impacts compared to the proposed action because the TSF as proposed would be designed to consolidate over time and the liner, cover, and seepage collection system would minimize potential for water pollution. In addition, placing the tailings in the pit would displace some of the waste rock that is to be placed in the pit under the proposed action which would increase the size of the WRF.
MS-97	Self-buffering tailings closure, involving a lime-rich cover layer over the TSF	This option could reduce the potential of ARD.	After removal of gold-bearing sulfides, POX, neutralization, cyanide destruction, and maintaining near neutral tailings pH, there is little driving force for ARD. Placing lime on the surface in a lime-rich layer would forestall revegetation. Additionally, this option would require large volumes of lime. The lime would need to be transported to the mine site by barge. This option is infeasible because ARD is unlikely, increased cost, and increased barging.
MS-98	Lined cover cap	Option was generated to provide the potential cap needed for consideration of option MS-100.	MS-100 eliminated, therefore this option is not applicable.
MS-100	Cover allowing run-on of surface water	Option was intended to minimize earthwork at the mine site.	The potential amount of surface water run-on creates technical hurdles for this option. On balance, it does not reduce environmental impacts compared to the full diversion of surface water in the proposed action.

Abbreviations:
ARD = acid rock drainage
MS = mine site
POX = pressure oxidation
TSF = tailings storage facility
WRF = waste rock facility

Table C-14: Mine Site Closure Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
MS-102	Using a hard cover with no re-vegetation for the mine site - Create a final cover that includes crushed rock to provide erosion protection, with minimal or no re-vegetation.	This option was considered because of its utility in other mine closure circumstances, where the lack of vegetation would discourage later human/recreational use, and where this was a desirable goal.	While feasible, allowing vegetation to reestablish is desirable for this project.
MS-105	Creating a hard (coarse rock) cover for TSF which does not encourage human or wildlife access.	Considered because the lack of re-vegetation would discourage later human/recreational use.	This option does not decrease environmental impacts compared to the proposed action. While feasible, allowing vegetation to reestablish is desirable for this project.
MS-107	Remote-sensing monitoring	Considered because of the potential to supplement on-site monitoring.	Not included as an action alternative, but would be considered by Donlin Gold and regulators during closure, considering the technology that is available at that time (approximately 30 years in the future). The option presents an opportunity to reduce the costs of mobilizing people to complete all of the monitoring. The effectiveness of post-closure monitoring is discussed in Chapter 3. The primary benefit of this option appears to be to potentially reduce the cost of post-closure monitoring and it appears to offer few environmental benefits. It would also require speculation of the technology available in the distant future. It is not a NEPA alternative.

Abbreviations:
MS = mine site
NEPA = National Environmental Policy Act
TSF = tailings storage facility

Table C-15: Down River Port and Cargo Facilities Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-2	Alternative design of the Dutch Harbor cargo & fuel terminals.	Suggested during scoping, intent unclear.	No clear alternative designs were obvious. Therefore, this option was eliminated because of its lack of specificity.
TI-4	Bethel Location #2 (an undeveloped parcel)	Three potential port locations in Bethel were being considered by Donlin Gold.	Early on, Donlin Gold was considering three potential port locations in Bethel. They have subsequently entered into an agreement with Knik Construction Co., Inc., the owner of the existing Bethel Yard Dock, to transfer and store freight and fuel. The Bethel Yard Dock bulkhead and staging area would likely require expansion to in part accommodate the Donlin Gold Project. Expansion of the existing dock and staging area would have reduced environmental impacts when compared to constructing an entirely new facility on undeveloped land. (The effects of expansion are being addressed in the EIS as indirect effects.)
TI-5	Bethel Location #3 (an undeveloped parcel)	Three potential port locations in Bethel were being considered by Donlin Gold.	Same as rationale for TI-4.
TI-6	Provide a floating port located in Bethel or in the Bering Sea at mouth of the Kuskokwim River.	A potential option to the proposed land based port area.	This option would result in increased environmental impacts, increased risk of hazardous material spills, safety risks, and increased technical/economic engineering challenges.
TI-8	Place the down river port on Fowler Island.	An option that would locate the down river port at a location other than Bethel.	This option was originally eliminated from the proposed project in preference for establishing the downriver port site in Bethel. The Bethel site can make use of existing infrastructure, reducing project complexity and footprint impacts. The Fowler Island option does not provide an environmental benefit.
TI-9	Place the down river port at Johnson Crossing.	An option that would locate the down river port at a location other than Bethel.	This option was originally eliminated from the proposed project in preference for establishing the downriver port site in Bethel. The Bethel site can make use of existing infrastructure, reducing project complexity and footprint impacts. The Johnson Crossing option does not provide an environmental benefit.
TI-10	Place the down river port in Goodnews Bay.	An option that would locate the down river port at a location other than Bethel.	This site is subject to strong ocean currents and swells and poses vessel draft restrictions. This option was originally eliminated from the proposed project in preference for establishing the downriver port site in Bethel because the Bethel site could make use of existing infrastructure, reducing project complexity and footprint impacts. This rationale was judged as reasonable and this option is viewed as not feasible because of the ocean currents, swells, and draft restrictions.

Table C-15: Down River Port and Cargo Facilities Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-11	Place the down river port at Eek Island.	An option that would locate the down river port at a location other than Bethel.	This site is low-lying and subject to flooding during high tides, making the construction and operation of infrastructure difficult. This option was originally eliminated from the proposed project in preference for establishing the downriver port site in Bethel because the Bethel site could make use of existing infrastructure, reducing project complexity and footprint impacts. The Eek Island option does not provide an environmental benefit.
TI-12	Place the down river port in Security Cove.	An option that would locate the down river port at a location other than Bethel.	This site is exposed to ocean swells during north and west winds. Sea conditions could delay lightering operations delaying the construction schedule and increasing construction costs. This option was originally eliminated from the proposed project in preference for establishing the downriver port site in Bethel because the Bethel site could make use of existing infrastructure, reducing project complexity and footprint impacts. This rationale was judged as reasonable and this option is viewed as not feasible because of its exposure to ocean swells.
TI-13	Place the down river port in Akiachak.	An option that would locate the down river port at a location other than Bethel.	This site poses vessel draft restrictions. This option was originally eliminated from the proposed project in preference for establishing the downriver port site in Bethel because the Bethel site could make use of existing infrastructure, reducing project complexity and footprint impacts. The Akiachak option does not provide an environmental benefit.
TI-14	Place the down river port in Napakiak.	An option that would locate the down river port at a location other than Bethel.	This site poses potential bank erosion concerns. This option was originally eliminated from the proposed project in preference for establishing the downriver port site in Bethel because the Bethel site could make use of existing infrastructure, reducing project complexity and footprint impacts. The Napakiak option does not provide an environmental benefit.

Abbreviations:
TI = transportation infrastructure

Table C-16: Barge Traffic Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-17	Use air transport for mining equipment and consumables.	Would potentially reduce the number of barges on the Kuskokwim River.	This option is technologically and economically infeasible due to the amount of cargo that will be required for this project; approximately 5,000 additional flights per season of a C130 aircraft would be required. This would have significant impacts on the airport of origin and the project site.
TI-19	Air transport of diesel fuel with the Bulk Aviation Transport Tank.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	This option is technologically and economically infeasible due to the amount of diesel that will be required for this project; 5,000 to 10,000 additional flights per season of a C130 aircraft would be required. This many additional flights would cause significant impacts to the airport of origin and at the project site.
TI-20	Air transport of diesel fuel by a commercial aircraft equipped with fuel storage capabilities.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	This option is technologically and economically infeasible due to the amount of diesel that will be required for this project; 5,000 to 10,000 additional flights per season of a C130 aircraft would be required. This many additional flights would cause significant impacts to the airport of origin and at the project site.
TI-22	Build a railroad from Bethel to the mine site for cargo and fuel transportation.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	Technological challenges and unfavorable ground conditions between Bethel and Aniak drive the economic infeasibility of this option. This option would have a large impact on Wetlands and other Waters of the U.S., in addition to the regulatory obstacles of installing a transportation corridor across the Yukon Delta National Wildlife Refuge.
TI-23	Build a road from Bethel to the Mine Site.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	Technological challenges and unfavorable ground conditions between Bethel and Aniak drive the economic infeasibility of this option. This option would have a large impact on wetlands and other waters of the U.S., in addition to the regulatory obstacles of installing a transportation corridor across the Yukon Delta National Wildlife Refuge.
TI-24	Build a road from Dillingham (Nushagak) to the mine site for cargo and fuel transportation.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	Technological challenges and length of the road result in the economic infeasibility of this option. This option would have a large impact on wetlands and other waters of the U.S., in addition to the regulatory obstacles of installing a transportation corridor across the Togiak National Wildlife Refuge.
TI-25	Build a road from Nenana to the mine site for cargo and fuel transportation.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	Technological challenges and length of the road drive the economic infeasibility of this option. This option would have a large impact on wetlands and other waters of the U.S.

Table C-16: Barge Traffic Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-26	Build a road from Cook Inlet to the mine site for cargo and fuel transportation.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	Technological challenges and length of the road drive the economic infeasibility of this option. This option would have a large impact on wetlands and other waters of the U.S.
TI-27	Roadless year round transport from Dillingham to the mine site for cargo and fuel transportation using Rolligons, an all-purpose, all-terrain, tractor-trailer combination.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	This option is technologically and economically infeasible for several reasons. Rolligons have a payload capacity of up to 120,000 pounds. Therefore, transporting the estimated 115,587 tons of cargo needed per year would require approximately 2,000 round trips, and an additional 2,400 round trips per season would be required for the 40 Mgal of diesel estimated to be needed per season. Perpetual use of Rolligons over the same route(s) would result in vegetative and subsequently soil substrate degradation resulting in eventual road construction being required.
TI-28	Roadless year round transport from Nenana to the mine site for cargo and fuel transportation using Rolligons.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	This option is technologically and economically infeasible for a combination of several reasons. The scale of transport needed casts doubts on whether this option could be made to work. Rolligons have a payload capacity of up to 120,000 pounds. Therefore, transporting the estimated 115,587 short tons of cargo needed per year would require approximately 2,000 round trips, and an additional 2,400 round trips would be required per season for the 40 Mgal of diesel estimated to be needed per season. Perpetual use of Rolligons over the same route(s) would result in vegetative and subsequently soil substrate degradation resulting in eventual road construction being required.
TI-29	Roadless year round transport from Cook Inlet to the mine site for cargo and fuel transportation using Rolligons.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	This option is technologically and economically infeasible for a combination of several reasons. The scale of transport needed casts doubts on whether this option could be made to work. Rolligons have a payload capacity of up to 120,000 pounds. Therefore, transporting the estimated 115,587 short tons of cargo needed per year would require approximately 2,000 round trips, and an additional 2,400 round trips per season would be required for the 40 Mgal of diesel estimated to be needed per season. Perpetual use of Rolligons over the same route(s) would result in vegetative and subsequently soil substrate degradation resulting in eventual road construction being required.

Table C-16: Barge Traffic Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-30	Build an ice/snow road to the mine site for transportation of cargo and fuel.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	This option is technologically and economically infeasible for a combination of several reasons including uncertain winter conditions and the scale of transport needs. Approximately 3,000 round trips, using B-train tanker trucks, would be required per season to deliver 40 Mgal of fuel, and approximately 2,900 trips to deliver cargo with standard tractor trailers container trucks. Perpetual use of ice roads over the same route(s) would result in vegetative and subsequently soil substrate degradation resulting in eventual road construction being required.
TI-31	Establish a winter snow cat route for transportation of cargo and fuel.	Would potentially reduce the number of barges on the Kuskokwim River and reduce the risk of diesel fuel releases to the river.	This option is technologically and economically infeasible for a combination of several reasons including uncertain winter conditions and the scale of transport needs. Heavy duty snow cats can haul approximately 3,000 pounds or 500 gallons, and would require 70,000 trips for cargo and an additional 80,000 trips to transport diesel.
TI-32	Use hovercrafts rather than barges for transportation of cargo and fuel to the mine site.	Hovercrafts are capable of moving over either open water or frozen river ice, providing a longer shipping season.	This option is technologically infeasible for this level of operation, hovercrafts can only carry approximately 22,000 pounds per trip (3,000 gallons of diesel), and would require 13,000 trips per season for diesel fuel, plus 10,000 trips for cargo.
TI-33	Limit barging during key commercial or subsistence fishing periods.	Would potentially reduce the impacts on Subsistence Fishing.	In light of detailed analysis of potential impacts, this has evolved into a monitoring and adaptive management proposal (see Chapter 5, Impact Avoidance, Minimization, and Mitigation, Table 5.7-1).

Abbreviations:
Mgal = million gallons
TI = transportation infrastructure

Table C-17: Up River Port and Mine Access Road Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-34	Build a road to the Yukon River.	Would eliminate barge traffic on the Kuskokwim River.	The shortest road option from the proposed mine site to a port location on the Yukon River would be approximately 53 miles long versus the 30 mile road proposed to Jungjuk. Additionally, several miles of the road would be in the Yukon River flood plain which would require elevating the road and port to prevent flooding. The road would be challenging due to permafrost and other geotechnical challenges but is technologically feasible at great expense. A road to a new port on the Yukon, with costs borne by Donlin Gold, is not cost effective and would create significantly greater environmental consequences, notably in wetlands displaced by construction. In order for this option to be feasible, it would require the eliminated options TI-35 and TI-38 or TI-39.
TI-35	Build a port on the Yukon River.	Would eliminate barge traffic on the Kuskokwim River.	Potential port locations include Great Paimute Island and Salmon Island. The available sites would require in-channel port facilities and involve substantial impacts to adjacent floodplain and wetland areas. This option would require the eliminated options TI-34 and TI-38 or TI-39.
TI-36	Tie into the state's planned road to the Yukon River.	Would eliminate the Angyaruaq (Jungjuk) Port, associated barge traffic on the Kuskokwim River and the mine access road from the port.	The Paimute-Kalskag Transportation Corridor, also known as the Yukon-Kuskokwim Freight Corridor, is a proposed Association of Village Council Presidents' project (funded through State of Alaska general fund appropriation) currently in the planning phase. A report on this potential project was recently presented at the Association of Village Counsel President's Annual Convention (2013). However, the project has no appropriation for construction, and is not currently on the ADOT&PF Statewide Transportation Improvement Program for construction funding or identified in an Alaska Statewide Long Range Transportation Plan. The proposed road does not qualify as a reasonably foreseeable option because it is unlikely to be available during the initial phases of mine construction and operation. Additionally, the Paimute slough is too shallow and narrow to accommodate the barges that are proposed.
TI-37	Building a port at the end of the State planned road to the Yukon River.	Would eliminate the Angyaruaq (Jungjuk) Port, associated barge traffic on the Kuskokwim River and the mine access road from the port.	This port option would be dependent on the Paimute-Kalskag Transportation Corridor (option TI-36). This road does not qualify as a reasonably foreseeable option for reasons explained in TI-36.

Table C-17: Up River Port and Mine Access Road Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-38	Up river barging on the Yukon River.	Would eliminate barge traffic on the Kuskokwim River.	Upriver barging requires transfer of cargo and diesel from the ocean barges to the river barges. Nome has a port/harbor that provides protection from ocean swells. However, only one acre of land is available for a staging area and Donlin Gold has identified a need for 21 acres for staging and storing containers. Additionally, the Nome harbor is too shallow to accommodate the fully loaded design ocean barges and would be extremely congested by the proposed Donlin Gold project barge traffic. It is very unlikely that using Nome infrastructure would facilitate successful transfer of the required goods. Lightering cargo containers and diesel fuel from ocean barges to river barges could possibly be done in deep water off the mouth of the Yukon River but would increase the probability of injuries, accidents, and spills, especially during periods of marginal weather and sea conditions. No other obvious port locations were identified and constructing a new port with adequate breakwaters to protect against storms would be expensive and introduce new environmental impacts. The Upriver Barging option would increase total river barge miles (annual trips times distance) from 47,092 under the Angyaruaq (Jungjuk) option to 51,240. This option would relocate the barge impacts from the Kuskokwim River to the Yukon River. This option would also require the eliminated options TI-34 and TI-35 or TI-36 and TI-37.
TI-39	Down river barging from Nenana (Tanana/ Yukon River).	Would eliminate barge traffic on the Kuskokwim River.	Downriver barging would probably need to be conducted through the Port of Anchorage because the proposed volumes of goods would more than double the existing volume shipped through Whittier during the summer. The Alaska Railroad would deliver the cargo and diesel to Nenana. Transferring the cargo alone (not considering the diesel) through Nenana would increase the volume of freight by 360%. Space for a 21 acre staging and storage area is not available at the port. The Nenana River is shallower than the Yukon or Kuskokwim requiring use of a two barge configuration instead of the four barges proposed for either the Donlin Gold proposed project or the Upriver Barging option. The Downriver Barging option would increase total river barge miles from 47,092 under the Angyaruaq (Jungjuk) option to 170,800. This option would relocate the barge impacts from the Kuskokwim River to the Yukon River. This option would also require the eliminated options TI-34 and TI-35 or TI-36 and TI-37.

Table C-17: Up River Port and Mine Access Road Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-39a	Establish and maintain a deeper and wider navigation channel between the river mouth and the upriver port.	Could reduce the potential for barges grounding in the river.	Dredging a navigation channel would be very expensive and would require frequent maintenance dredging. While a wider, deeper channel could reduce the chances of grounding, the environmental effects of dredging would be much greater than the effects of grounding. Donlin Gold has studied the existing widths and depths of the natural channel and has designed a transportation plan that appears feasible without the need for channel dredging. Donlin Gold has also committed to use of state of the art navigation and communication equipment in tugs used on the project, a practice that would greatly reduce the probability of grounding. Additionally, the use of double-hulled barges for all diesel transport would nearly eliminate the risk of spills from grounding events.
TI-40	Place the upriver port in Aniak. (Aniak Port option)	Location would avoid barge traffic on shallows of upper Kuskokwim River.	This option does not differ significantly in terms of impacts from the Birch Tree Crossing port location that was forwarded for analysis. The Birch Tree Crossing option will provide for a reasonable range of alternatives to the proposed action.
TI-41	Build a road from the proposed upriver port in Aniak (TI-40) to the mine site.	Would be required if the up river port was located at Aniak (option TI-40).	This option is coupled with option TI-40. This option does not differ significantly in terms of impacts from the Birch Tree Crossing road location that will be forwarded for analysis. The Birch Tree option will provide for a reasonable range of alternatives to the proposed action.
TI-47	Use riprap for the Angyaruaq (Jungjuk) Port design.	Port design feature to further shield against damage caused by ice break up and high water.	This option is economically infeasible because of the lack of a regionally available source of riprap quality rock. There are technical engineering challenges with the vulnerability of riprap to be ‘plucked off’ the embankment as the ice goes out each spring.
TI-48	Use a removable floating barge & ramp for the Angyaruaq (Jungjuk) Port.	Would potentially reduce the footprint of the port.	This option is not recommended because it would be technologically and economically challenging. It presents additional risks (of accidental spills) during the operational phase, and no obvious advantage over a fixed immovable port other than reduced footprint.
TI-49	Dredge a deeper floating basin at the Angyaruaq (Jungjuk) Port.	Port design feature to reduce potential disturbance of river bottom.	This option creates a variety of impacts. Upon “weight-of-the-evidence” review, many environmental impacts (aquatics and water quality) were marginally greater and costs were substantially higher. This option would also require regular maintenance dredging and disposal of dredged material. Absent any known corresponding operational benefits, this option was not recommended to be carried forward.

Table C-17: Up River Port and Mine Access Road Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-51	Use a seasonal/temporary port at Angyaruaq (Jungjuk).	Port design feature to further shield against damage caused by ice break up and high water.	This option was not deemed technologically or economically feasible at the size and capacity needed for this project.
TI-52	Move the pilings landward of the bank at Angyaruaq (Jungjuk) Port.	Locate the staging area upslope and away from the shoreline to minimize placement of fill along riverbanks.	The port would be constructed with a wharf parallel with the river bank that would be used to unload barges. The wharf would need to have adequate water depth at the face to accommodate a fully loaded barge. If the wharf face was moved landward of the bank, it would be necessary to remove/ dredge the existing material to provide adequate water depth and it is probable that some annual maintenance dredging would be required to remove material transported downstream and deposited in this area.
TI-53	Add a second slip to the Angyaruaq (Jungjuk) Port.	Could enhance the efficiency of unloading barges.	Donlin Gold has indicated they do not anticipate the need for a second slip. Adding the second slip would increase the footprint of the port, thereby increasing environmental impacts. This option is eliminated because of a lack of need and potential for increased impacts.
TI-55	Use "Hi-Float" or "Chip Seal" on the road to the mine site from Angyaruaq (Jungjuk) Port.	Design feature that could aid in stabilizing the road surface reducing erosion and sedimentation, and airborne dust.	This option is economically impractical. Because of the volume and weight of the truck traffic, the hi-float or chip seal layers would need to be extensively thickened.
TI-56	Paving the road to the mine site from Angyaruaq (Jungjuk) Port.	Design feature that could aid in stabilizing the road surface reducing erosion and sedimentation, and airborne dust.	This option is economically impractical. Because of the volume and weight of the truck traffic the pavement layers would need to be thickened.
TI-56a	Reduce the Angyaruaq (Jungjuk) Port Access road to one lane in wetlands	Would reduce wetland impacts.	To transport the cargo and diesel to the mine site will require a fleet of 10 trucks, and they would arrive at Angyaruaq (Jungjuk) approximately every 27 minutes. These trucks would be hauling diesel, cyanide, and other dangerous goods. A one-lane road could affect the ability to efficiently move the cargo and diesel and could increase the risk of accidents. Safety and reliability issues lead the Corps to conclude that the option should be dismissed.

Table C-17: Up River Port and Mine Access Road Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-57b	Reclaim and decommission the road from Angyaruaq (Jungjuk) Port to the mine site at closure.	Would limit the timeframe of the effects of the road.	This option is not recommended because the road is a necessary part of the long term water monitoring plan. The reclamation and final fate of the road will be fully addressed in the EIS.

Abbreviations:
ADOT&PF = Alaska Department of Transportation and Public Facilities
EIS = environmental impact statement
TI = transportation infrastructure

Table C-18: Mine Airstrip Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-59	Improve Crooked Creek's airfield.	An option that would replace the proposed airstrip, reducing surface impacts and air traffic at the mine site.	Options TI-59 and TI-60 were considered together because they would both be necessary. The combination will not remove the need for a mine access road or port and requires a second road. The amount of airport improvement needed would be extensive and expensive presenting both technological and economic challenges. There is no obvious environmental benefit.
TI-60	Build a road between Crooked Creek and the mine site.	An additional road required if an improved Crooked Creek Airfield was utilized and a site airstrip was not constructed (option TI-59).	Options TI-59 and TI-60 were considered together because they would both be necessary. The combination will not remove the need for a mine access road or port and requires a second road. The amount of airport improvement needed would be extensive and expensive presenting both technological and economic challenges. There is no obvious environmental benefit.
TI-62	Reclaim the mine site airstrip after operation was complete.	Would limit the timeframe of the effects of the airstrip.	This option is not recommended because the airstrip is a necessary part of the long term water monitoring plan. The reclamation and final fate of the airstrip will be fully addressed in the EIS.

Abbreviations:
EIS = environmental impact statement
TI = transportation infrastructure

Table C-19: Pipeline Construction Airstrip Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-65	Improve "Kiska Metals" strip for use during pipeline construction.	To attempt to minimize the number of airstrips.	Economically infeasible because of the need for a road to the ROW and the lack of a logistical advantage over the proposed action.
TI-66	Substitute fixed wing planes with helicopters for the construction of the pipeline.	Would reduce the size of the airstrip to a smaller helicopter landing area.	The option to replace fixed wing planes with helicopter use was judged economically infeasible. However, supplemental helicopter use could be used as a mitigating measure in specific cases.
TI-68	Return the gravel used for temporary pipeline construction airstrips to the material sites for full restoration of both airstrip and material sites.	Would return the material site and airstrip to pre-construction surface conditions.	This option is economically infeasible, plus impacts were not lessened to an appreciable degree given the activities necessary to return gravel to the material site.

Abbreviations:
TI = transportation infrastructure

Table C-20: Power Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-71	Using wind power as the main source of power.	Would reduce on-site gas or diesel fired power generation.	Wind power is technologically and economically infeasible given the scale of the power needs at the mine site. Wind is, at best a supplemental intermittent power source.
TI-72	Using nuclear power as the main source of power.	Would replace on-site gas or diesel fired power generation and the natural gas pipeline.	The cost of operating a nuclear power plant at the scale needed by the mine site was considered economically infeasible because it would add extraordinary costs to the mine's operations. The logistical challenges of operating a nuclear power plant at the scale needed in remote Alaska is beyond proven practice and borders on technologically infeasible even before the challenges of permitting such a nuclear site are considered.
TI-73	Using run-of-the-river hydropower as the main source of power.	Would replace on-site gas or diesel fired power generation and the natural gas pipeline.	This option is technologically infeasible at the scale needed to generate the energy level needed by the mine site.

Table C-20: Power Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-74	Using conventional hydropower as the main source of power.	Would replace on-site gas diesel fired power generation and the natural gas pipeline.	Both the technological (including permit-ability) and economic challenges of a conventional hydropower project of the scale needed to meet the Purpose and Need of the project on the Kuskokwim River would be daunting. Hydropower would introduce additional environmental effects that would arguably exceed the proposed action. The agencies did not recommend taking this option forward for further analysis.
TI-75	Using biomass as the main power source.	Would replace on-site gas or diesel fired power generation and the natural gas pipeline.	This option is infeasible because of the lack of a local source of biomass sufficient to replace gas or diesel fired power generation. The logistical challenges involved in transporting biomass to the mine site were considered to add extraordinary costs and therefore this option is economically infeasible.
TI-76	Using waste-to-fuel as the main power source.	Would replace on-site gas or diesel fired power generation and the natural gas pipeline.	This is technologically and economically infeasible as an option to replace a natural gas pipeline.
TI-77	Using coal as the main power source.	Would replace on-site gas or diesel fired power generation and the natural gas pipeline.	This is technologically and economically infeasible due to the costs and logistics of transporting, storing, and converting coal to power. This option as also presents additional air and climate change impacts.
TI-78	Using peat power as the main source of power.	Would replace on-site gas or diesel fired power generation and the natural gas pipeline.	This option is infeasible because of the lack of a local source of peat sufficient to replace gas or diesel fired power generation. The logistical challenges involved in transporting peat to the mine site were considered to add extraordinary costs and therefore this option is economically infeasible. Any impacts of harvesting peat in the quantities required to supply the projects' power needs are unwarranted. (Peat is considered a biomass so TI-75 and TI-78 were considered together.)
TI-79	Combining two or more of options TI-69 through TI-78 (energy alternatives).	Would consider a combination of options.	The proposed action is a dual fuel power plant (primarily natural gas [TI-69] and, as a backup, diesel [TI-70]). The other power alternatives remain infeasible to produce a portion of the power supply, especially considering the proposed action would provide natural gas to the site.

Table C-20: Power Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-80	Using natural gas-fired electricity generated off-site.	Would replace on-site gas or diesel fired power generation and the natural gas pipeline.	This option is technologically and economically infeasible. This option does not present the air and climate change impacts of options TI-80 through TI-85, but still cannot pass the feasibility screen. The length and remoteness of a transmission line from Beluga would present reliability risks associated with potential shut down from damage caused by wind, ice buildup, and possibly avalanches. Therefore, this option would not meet the long-term stable energy supply component of Donlin Gold's stated purpose and need (refer to Chapter 1) which refers to the need to: . . . provide a long-term stable supply of natural gas to meet energy needs for the proposed Donlin Gold mine project. The remoteness of the line would exacerbate reliability issues associated with rugged terrain described above, as maintenance activities and repair would be hindered by accessibility constraints—access to the mine site is seasonal via the Kuskokwim River or by aircraft, as weather conditions allow. Further, the power grid in the state does not have built in redundancy. The loss of reliable energy would directly impact the profitability (i.e., economic feasibility) of the project. Therefore, this option was determined to include infrastructure infeasible for application in remote and mountainous conditions in western Alaska, and to not provide sufficient economic benefits to meet either the Donlin Gold's purpose and need or the Corps' NEPA Purpose and Need, as stated in Chapter 1. In addition, energy losses would occur over the long distance of the transmission lines, making it a less energy efficient option than a gas line. This option would also be expected to result in greater visual impacts to sensitive resources such as the Iditarod National Historic Trail, when compared to the proposed action which includes a buried natural gas line. An underground transmission line was also considered and is technologically feasible. An underground transmission line would also be subject to energy loss and would require a manhole every 2,000 feet. Underground transmission line would be an order of magnitude more expensive than an overhead transmission line and would be more expensive than the proposed natural gas pipeline.

Table C-20: Power Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-81	Purchase electricity from the existing grid to power the mine site.	Would replace on-site gas or diesel fired power generation and the natural gas pipeline.	There is not excess capacity in the existing system to accommodate the 227MW of power needed for the project. Therefore, construction of an off-site power plant would be required (refer to TI-80, TI-84, TI-87, and TI-88). Transmission to the project site would be required over rugged and remote terrain that could present reliability issues as a result of weather conditions, avalanches, and maintenance access (refer to TI-80). In addition, depending on the location of the new plant, it may also require routing through FWS refuges (refer to TI-84, TI-87, and TI-88).
TI-82	Purchase power from Watana Susitna Hydro-electric.	Would replace on-site gas or diesel fired power generation and the natural gas pipeline.	This option is technologically and economically infeasible (see TI-80 and TI-81). Further, this option being available during mine site construction or the early operation phases is not reasonably foreseeable.
TI-83	Purchasing power generated from the off-site Williamsport Coal Plant.	Would replace on-site gas or diesel fired power generation and the natural gas pipeline.	This option is technologically and economically infeasible (see TI- 80 and TI-81) and presents increased air and climate change impacts.
TI-84	Purchasing power generated off-site from a coal plant to be located in Bethel.	Would replace on-site gas or diesel fired power generation and the natural gas pipeline.	This option was the one coal fired power plant option that was not clearly technologically and economically infeasible because of the smaller length required for a transmission line. That said, it is also not recommended to be forwarded given its cost, increased air and climate change impacts, impacts to wetlands between Bethel and Aniak, and soft ground conditions between Bethel and Aniak. The transmission line would also need to be permitted through the Yukon Delta National Wildlife Refuge.
TI-85	Purchasing power generated off-site from the Beluga Coal Plant.	Would eliminate the natural gas pipeline and on-site power plant.	This option is technologically and economically infeasible; see TI-80.
TI-86	Purchasing power generated off-site at the Healy Power Plant (Coal).	Would eliminate the natural gas pipeline and on-site power plant.	This option is technologically and economically infeasible; see TI-80.

Table C-20: Power Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-87	Building a Bethel LNG Plant with an associated pipeline to the mine site.	Would eliminate the natural gas pipeline.	During Alternatives Workshop #2, on August 28-29, 2013, the regulatory obstacles to building surface infrastructure through the Yukon Delta National Wildlife Refuge (NWR) (as would be required for TI-87 or TI-88) were considered a critical issue. It was recognized that a road, a railroad, a pipeline, or a transmission line would involve displacement of a significant volume of wetlands, given the topography of the Yukon Delta NWR and the distances involved. However, a transportation and utility project is subject to the special regulatory review of Title XI of the Alaska National Interest Lands Conservation Act (ANILCA). These regulations do not categorically preclude a transportation corridor, but they do impose strict procedural requirements, particularly the following: *§1105. In any case in which there is no applicable law with respect to a transportation or utility system, the head of the Federal agency concerned shall, within four months after the date of filing of any final Environmental Impact Statement, make recommendations for purposes of §1106(b), to grant such authorizations as may be necessary to establish such system, in whole or in part, within the conservation system unit concerned if he determines that--* *(1) such system would be compatible with the purposes for which the unit was established; and* *(2) there is no economically feasible and prudent alternative route for the system.* (continued below)

Table C-20: Power Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
TI-88	Building a Bethel LNG fuel power facility with a transmission line to the mine site	Would eliminate the natural gas pipeline and on-site power plant	At the workshop, the FWS representative requested additional time to confirm with the Yukon Delta NWR whether this regulatory requirement was such that the surface transportation options were not feasible. During the cooperating agency meeting the next week, on September 4, 2013, the FWS representative reported back as described in the notes: *FWS completed an action item from the Alternatives Workshop #2 to talk to the Yukon Delta National Wildlife Refuge about options for a pipeline, transmission line, or other utility corridors from Bethel to the mine site through the Refuge. This would represent a major regulatory challenge that would require a separate NEPA document. It is appropriate that the road and the railroad options would use this regulatory hurdle language to explain why these alternatives are not feasible.* The EIS Team concludes that the position of the FWS on surface transportation options through the Yukon Delta NWR is the decisive factor in making these options infeasible.

Abbreviations:
§ = Section
ANILCA = Alaska National Interest Lands Conservation Act
FWS = U.S. Fish and Wildlife Service
LNG = liquid natural gas
MW = megawatt
NEPA = National Environmental Policy Act
NWR = National Wildlife Refuge
TI = transportation infrastructure

Table C-21: Pipeline Routing and ROW Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
PL-2	Routing an overland natural gas pipeline from Dillingham (Nushagak) to the mine site.	A shorter pipeline route alternative that would avoid crossing the Alaska Range.	Technologically infeasible because natural gas is not available in Dillingham in sufficient quantities.
PL-3	Routing an overland natural gas pipeline from Nenana to the mine site.	A pipeline route that could connect to a planned natural gas pipeline from the North Slope and would avoid crossing the Alaska Range.	Technologically infeasible because natural gas is not available in Nenana for the reasonably foreseeable future.
PL-4	Using alternative routes that do not require substantial grading of hillsides for the pipeline ROW.	A design feature or mitigation action that would reduce environmental impacts associated with pipeline construction.	This option is not recommended as a potential action alternative component; it would be considered as a potential mitigation measure as the process proceeds. Update that applies to all options considered as a potential mitigation measure or as a “(mandatory) design feature” common to all alternatives: There was considerable discussion of “mitigation” and “design features” during Alternative Workshop number 2. It was discussed that many pipeline component options that were eliminated fell within this category. Further, it was expressed that the recommendation to eliminate an option for consideration as an alternative did not preclude its utility as a potential mitigating measure or design feature.
PL-6	There was an option to consider pipeline route options near established guide camps to reduce viewshed impacts, e.g., near Windy River.	A design feature or mitigation action that would reduce environmental impacts associated with pipeline construction and operation.	Minor alignment adjustments will be considered during the permitting process while coordinating with land owners or resource managers. As such, avoiding viewshed impacts would be one of several factors considered in localized siting determinations as engineering advances, and adjustments are made during construction.
PL-9	Local route option at Lower Theodore River, MP 0 - MP 5.	A shorter routing alternative to the proposed Pretty Creek alignment.	The Pretty Creek alignment would utilize existing infrastructure, therefore the Theodore River option would not reduce environmental impacts.
PL-11	Local route option, Little Mount Susitna East, MP 9 - MP 29.	A routing alternative to the proposed Little Mount Susitna west alignment.	Transects low lying flat topography areas and would result in more stream crossings and wetland disturbances than the proposed alignment.
PL-13	Local route option, Theodore River Alternate East, MP 32 - MP 49.	A routing alternative to the proposed Theodore River Alternate west alignment.	Transects low lying flat topography areas and would result in more stream crossings and wetland disturbances than the proposed alignment.

Table C-21: Pipeline Routing and ROW Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
P-15	Local route options along Skwentna River - south, MP 58 – MP 70.	A routing alternative to the proposed Skwentna River - north alignment.	Transects low lying flat topography areas and would result in more stream crossings and wetland disturbances than the proposed alignment.
PL-16	Regional route option through Alaska Range over Merrill Pass.	An alternative pipeline route variation for crossing the Alaska Range.	This option would require pipeline construction and operations in Lake Clark National Park and Preserve resulting in regulatory complexity, potential land use conflicts, and impacts to designated wilderness areas.
PL-18	Local route option on south side Alaska Range via North Round Mountain, MP 95 – MP 98.	An alternative pipeline route variation in the vicinity of Round Mountain.	Unstable ice-rich soils along steep sideslope terrain make this option technically infeasible.
PL-19	Route option through Alaska Range via Goodman Pass west.	An alternative pipeline route variation for crossing the Alaska Range.	Steep terrain, geological hazards, and floodplain issues due to location in a constrained narrow valley, make this option technically infeasible.
PL-20	Route option through Alaska Range via Goodman Pass east.	An alternative pipeline route variation for crossing the Alaska Range.	Steep terrain, geological hazards, and floodplain issues due to location in a constrained narrow valley, make this option technically infeasible.
PL-21	Route option through Alaska Range via Rainy Pass and Dalzell Gorge, Egypt Mountain, south, MP 141 – MP 150.	An alternative pipeline route variation for crossing the Alaska Range.	Transects low lying flat topography areas and would result in more stream crossings and wetland disturbances than the proposed alignment.
PL-23	Route option through Alaska Range via Rainy Pass and Dalzell Gorge, local route option to avoid salt lick 2-3 miles west of Egypt Mountain, ~MP 146 – MP 147 on Egypt Mountain north route.	The intent of this option would be to reduce impacts to wildlife by avoiding a known salt lick area.	Associated with PL-25 that has been eliminated.
PL-25	Route option through Alaska Range via Jones Pass, MPs J 105 – J 150, local route option further to north away from salt lick near Egypt Mountain.	The intent of this option would be to reduce impacts to wildlife by avoiding a known salt lick area.	The Farewell Mineral Licks are located approximately one-half mile southeast of the proposed pipeline alignment and would therefore be avoided (Farewell Mineral Lick Survey, Donlin Gold, August 2013).

Table C-21: Pipeline Routing and ROW Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
PL-26	Regional route option through Alaska Range via Kichatna River Valley; route northwest at Skwentna to Kichatna River then west, bypassing 58 miles co-location with INHT.	The intent of this option was to reduce impacts to the INHT.	The route as proposed was a general concept, and additional work was conducted by Donlin Gold to determine optimal pipeline location to ensure constructability and pipe integrity. Donlin Gold prepared a memorandum dated March 6, 2014 that documented their position that the Kichatna option should be dismissed from further analysis: • Greater overall surface disturbance; • More wetlands impacts; • More impacts to aquatic resources due to multiple river crossings; • Visual impacts to Denali National Park and Preserve; • Enhanced access into a previously undeveloped area; • Additional pipeline integrity issues; and • Significant additional costs for the development and operation of the line. URS reviewed the work conducted by Donlin Gold and their consultants and prepared an analysis of environmental tradeoffs to include wetlands, geohazards, Iditarod Trail collocation and proximity, and cultural resources. The URS review confirmed and quantified many of the concerns expressed by Donlin Gold. A comparison of the technical information on impacts for the selected resources showed that the Kichatna option would increase impacts to wetlands and river channels by an important degree, when compared to the proposed route. Exposure to geohazards would also be increased. The Corps determined on May 6 that the Kichatna option was not a reasonable alternative and eliminated it from detailed analysis in the EIS. The decision was shared with cooperating agencies in an email from the Corps on May 6.
PL-28	Local route option, St. Johns Hill/Windy Fork north, MP 155 – MP 167.	A routing alternative to the proposed St. Johns Hill/Windy Fork south alignment, MP 155 – MP 167.	Downslope with more wetlands, permafrost areas, and larger creek crossings than the proposed alignment.

Table C-21: Pipeline Routing and ROW Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
PL-29	Local route option, Big River north, MP 187 – MP 192.	A routing alternative to the proposed South Fork Kuskokwim to Big River Area option that includes Big River south.	Downslope with more wetlands, permafrost areas, and larger creek crossings than the proposed alignment.
PL-30	Move regional route north along face of Alaska Range, MP 150 – MP 194, to avoid important transitional habitat for wildlife and reduce hunting pressure (from improved access).	Reduce environmental impacts associated with pipeline construction and operation.	This option would route the pipeline through black spruce habitat instead of the transitional habitat. Warm permafrost underlies the black spruce habitat in the area and constructing a pipeline in the warm permafrost would probably result in melting of the permafrost and thaw settlement. Thaw settlement could lead to strains impacting pipe integrity and increased ongoing maintenance to prevent channeling surface flow. This ongoing maintenance could require summer and fall access, equipment use, and camps and aircraft use. The transitional habitat is drier and less likely to experience thaw settlement. Additionally, clearing a linear route through the black spruce would be very visible from the air or higher vantages. The vegetation in the transitional habitat is also sparser and the ROW clearing would pose less of a visual impact than clearing the black spruce. Minor alignment adjustments will be considered during the permitting process while coordinating with land owners or resource managers. As such, avoiding transitional habitat would be one of several factors considered in localized siting determinations as engineering advances, and adjustments are made during construction.
PL-32	Local route option, Tatlawiksuk River south, MP 212 – MP 214.	A routing alternative to the proposed Tatlawiksuk River north alignment, MP 213 – MP 216.	Transects an area with less suitable ground conditions than the proposed alignment. (Increased wetlands, low ground and related geotechnical challenges).
PL-34	Local route option, Kuskokwim River south, MP 239 – MP 241.	A routing alternative to the proposed Kuskokwim River north alignment MP 240 – MP 242.	Less access to upland areas, more turns and more stream crossings than the proposed alignment.
PL-36	Three local route options near Moose Creek.	A routing alternative to the proposed Moose Creek alignment, MP 256 - MP 263.	More turns, longer distance, more low areas, and less access for equipment than the proposed action.

Table C-21: Pipeline Routing and ROW Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
PL-38	Local route option - Kuskokwim Hills south, MP 279 – MP 308 east side E. George River - north, MP 284 – MP 287.	An alternative pipeline route variation in the Kuskokwim Hills.	Wet lowland areas and potential land use conflicts on privately owned lands make this option technically infeasible.
PL-39	Local route option - Kuskokwim Hills south, MP 279 – MP 308 east side E. George River - south, MP 284 – MP 287.	An alternative pipeline route variation in the Kuskokwim Hills.	Wet lowland areas and potential land use conflicts on privately owned lands make this option technically infeasible.
PL-41	An option that reduces the initial clearing requirements for the majority of the ROW, preferably to less than 50 feet.	A design feature or mitigation action that would reduce environmental impacts associated with pipeline construction.	This is a mitigation measure that could be used when necessary on a site specific basis. Options to reduce the scale of the pipeline are not technologically feasible. Options that would eliminate the need for the pipeline were discussed under Transportation Facilities.
PL-42	Avoid construction alternatives that require substantial grading of hillsides for the pipeline ROW.	A design feature or mitigation action that would reduce environmental impacts associated with pipeline construction.	This is a mitigation measure that could be used when necessary on a site specific basis.
PL-44	An option that does not require clearing of vegetation every 10 years, to preserve early reclamation.	A design feature or mitigation action that would reduce environmental impacts associated with pipeline operations (see also PL-46).	This option recognizes that agencies can coordinate to refine pipeline clearing practices that both meet Pipeline Safety Act regulations and protect important ecological values. These efforts are generally coordinated among the state and federal land management agencies, ADF&G and PHMSA. As such, it will be considered as a mitigating measure.
PL-46	Coordinating with PHMSA to refine clearing requirements in consideration with PHMSA's regulations and the ecological values.	A mitigation action that would reduce environmental impacts associated with pipeline ROW clearing operations.	This option recognizes that agencies can coordinate to refine pipeline clearing practices that both meet Pipeline Safety Act regulations and protect important ecological values. These efforts are generally coordinated among the state and federal land management agencies, ADF&G and PHMSA. As such, it will be considered as a mitigating measure. It is not a viable action alternative because the specifics need to be determined by the jurisdictional agencies.

Table C-21: Pipeline Routing and ROW Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
PL-47	Installing slope breakers and trench breakers at wetland boundaries to prevent trenches from draining wetlands.	A mitigation action that would reduce environmental impacts to wetlands associated with pipeline construction.	This option would be considered as a potential mitigation measure as the process proceeds. This technique further needs careful site specific engineering design to avoid unanticipated wetland consequences. The EIS Team did not recommend this option be carried forward as a gas pipeline-wide alternative.
PL-50	Constructing a permanent dirt road or work pad alongside the entire length of pipeline ROW for operations and maintenance.	Would provide enhanced access to the pipeline for operations and maintenance.	This option would increase footprint impacts along the length of the pipeline and is not required for pipeline operations.
PL-51	Further restricting public access to the ROW.	A design feature or mitigation action that would reduce indirect environmental impacts associated with pipeline operations.	This option is problematic as a potential action alternative because the pipeline ROW is not an “exclusive use” ROW. Limitations on public use may be considered as mitigation but would need additional authorization and process by land management agencies. This will be considered as a potential mitigation measure as the process proceeds but is not a unique component of an action alternative.

Abbreviations:
ADF&G = Alaska Department of Fish and Game
EIS = environmental impact statement
INHT = Iditarod National Historic Trail
MP = milepost
PHMSA = Pipeline and Hazardous Materials Safety Administration
PL = Pipeline
ROW = right-of-way

Table C-22: Pipeline Design and Construction Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
PL-52	Facilitating local communities in acquiring a natural gas supply from the pipeline.	Scoping comment was to provide for a source of gas for nearby communities.	This option is outside of the Purpose and Need for this project. (The proposed Donlin pipeline will be permitted as a common carrier pipeline and has the capacity to carry additional supply to the region).
PL-54	An option to reduce the size of the pipeline or possibly even eliminate it.	Suggested as a means of reducing or eliminating environmental impacts associated with pipeline construction and operations. Because this project was determined by the Corps to be not water dependent, alternatives to pipeline wetlands crossing are presumed to exist.	Eliminating the pipeline would be part of the “no action” alternative. For the mine to exist without a natural gas pipeline, the power plant would need to be fueled with diesel. The increased demand for diesel would nearly triple the barging of diesel on the Kuskokwim River. This level of barging is considered infeasible. Size reduction is not recommended to be carried forward because a smaller pipeline would not reduce footprint and higher operating pressures would be required which would create additional risks.
PL-56	Constructing an above-ground natural gas pipeline.	Could reduce environmental impacts associated with pipeline burial.	Option is economically infeasible because it would add extraordinary costs. Further, above ground design for the natural gas pipeline would not significantly reduce environmental impacts associated with conventional buried natural gas pipeline techniques. Above ground construction could be applied as a design feature in specific situations that may be driven by geotechnical or other environmental considerations, as is the proposed design for two fault crossings. The feasibility analysis considered the difference in design requirements between natural gas and petroleum fluids in sub-arctic conditions.

Table C-22: Pipeline Design and Construction Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
PL-57a	For Alternative 3B – Diesel Pipeline, construct aboveground.	Option could reduce impacts associated with trenching and burial.	A Donlin Gold diesel line would be an ambient temperature line and therefore there would not be the same drivers for construction in permafrost. While it is conceivable that portions of the alignment could be built aboveground, there are many reasons not to go above ground in some of the more sensitive locations such as river crossings, through the Alaska Range, and along the Iditarod National Historic Trail. As a general rule, above ground pipelines usually cost about twice as much as buried pipelines, which would have significant impacts on overall project economics. Buried cross country pipelines are the norm throughout the U.S. as they are considered safer due to the protection from impact provided by burial. If Alternative 3B is ultimately selected as the preferred alternative, above ground construction to mitigate local hazards such as fault crossings or sensitive permafrost would be evaluated and, if needed, would be proposed as design features.
PL-58	Using the minimum tool concept that is used in wilderness areas (i.e., hand tools or much smaller equipment than usual) for trenching on hillsides.	Option could reduce impacts associated with trenching and burial.	It is not feasible to install the proposed pipeline using hand tools or small equipment.
PL-60	Requiring a dewatering filter bag or geotextile bag when dewatering a trench.	A design feature or mitigation action that would reduce environmental impacts associated with trench dewatering.	This option could become a mitigating measure for any of the action alternatives.
PL-64	Impressed current cathodic protection at significant river crossings.	A design feature or mitigation action that could reduce corrosion risks at significant river crossings.	This option is not forwarded to be an "Action Alternative" but remains under consideration as a potential method to prevent corrosion. The evaluation and selection of cathode protection would occur post-NEPA during final design. "Active" cathodic protection requires specific design on a site-by-site basis.
PL-66	Options in event HDD frac-out or scour risk is high (e.g., bridges, aerial, other).	A design feature or mitigation action that could reduce scour risks at significant river crossings.	Subsequent to the alternatives development process, Donlin Gold completed additional geotechnical investigations for HDD crossings. The Proposed Action crossings appear feasible without extreme measures such as bridges. HDD design and risk will be confirmed in final design.

Table C-22: Pipeline Design and Construction Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
PL-67	Option for HDD at all fish-bearing streams.	Option was intended to further reduce risk to fish bearing streams.	Option is economically infeasible for line-wide application because it would add extraordinary costs. That said, HDD application beyond the proposed action will be considered as a site-specific mitigating measure as appropriate to protect resources.
PL-70	Move visible pipeline components further from the Kuskokwim shore.	Option was intended to reduce visual impacts.	This option was not forwarded as a routing alternative but retained as a potential mitigation action or design feature. The location and any potential vegetation buffer will be considered in context of sound pipeline engineering, governing regulations and mitigation of visual resource impacts during permitting and final design.
PL-72	Alternative Crossing that further avoids Devil's Elbow cemetery.	Option was intended to avoid proximity to this site.	Further analysis of the proposed ROW location indicated no conflict. The NHPA 106 Programmatic Agreement would address the potential for cultural resources impacts potentially arising during construction.
PL-74	Use freeze depressants for hydro-testing if testing is done in winter or shoulder seasons.	Would allow for pipeline integrity testing during the winter.	There is no winter testing currently proposed. This option would introduce contaminated water that would then need to be disposed.
PL-75	Use air testing for pipeline integrity testing.	Would eliminate water use and discharges associated with hydrostatic testing for pipeline integrity.	It is not feasible to use only air testing. Pipeline option PL-76 includes the limited application of air testing where practical. PHMSA provided additional technical input that air testing is safe and appropriate only in very limited circumstances.
PL-77	Option for trucking water if water sources inadequate.	To minimize draw from local water sources.	Option was not forwarded for development of an "Action Alternative." To some degree, this is assumed to be part of the proposed action because draws from inadequate water sources are not feasible. Option will remain under consideration for a mitigation action upon consideration of the hydrologic environment of the pipeline routing.

Abbreviations:
HDD = horizontal directional drilling
NEPA = National Environmental Policy Act
NHPA = National Historic Preservation Act
PHMSA = Pipeline and Hazardous Materials Safety Administration
PL = pipeline
ROW = right-of-way

Table C-23: Above-ground Infrastructure and Facilities Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
PL-79	Alternative placement of valve stations to avoid visual impacts to local businesses, the INHT, hunting/guiding camps and cabins	Option considered to avoid creating visual impacts.	Option was not forwarded for "Action Alternative" development because valve stations are placed based upon an engineered design. Nevertheless, site-specific mitigation may be feasible depending upon the nature of the visual impacts.
PL-80	Place a valve station close to Rainy Pass Lodge and Kiska Metals.	Scoping comment was to provide for a source of gas for existing nearby facilities.	Not necessary to meet the Purpose and Need for the project. Proponent for this proposal can address this issue via the common carrier regulations if a pipeline is constructed along this alignment.
PL-81	Place additional valves before/after stream crossings.	Suggested as a design feature to protect streams from pipeline ruptures, however this technique is not applicable to a non-liquids pipeline.	Significant cost increase for no apparent benefit considering the proposed action is a non-liquids pipeline. This option is incorporated into Alternative 3B – Diesel Pipeline.
PL-83	Increase the number of remote closure valves.	To limit release in the event of a pipeline leak or rupture	Possible additional valves remain under consideration during permitting and final design. It should be noted that a leak from the proposed natural gas pipeline would not be likely to contaminate the land and water like a leak from a liquids pipeline would.
PL-87	Gas-powered compressor station with emissions controls	To assure that a gas-powered compressor would have emissions controls.	Proposed action includes an electrically powered compressor station. Gas power would not appear to reduce either impacts or risk of pollution.
PL-88	Providing storage areas to divert pipeline contents in the event of a breakage.	Suggested as design feature to contain pipeline contents in the event of a rupture, however this technique is not applicable to a non-liquids pipeline.	Not recommended primarily because it is not applicable for a non-liquids pipeline. This option would be considered if Alternative 3B – Diesel Pipeline were selected in the ROD.
PL-91	Improving pipeline security by burying the pipeline even at fault crossings.	Would provide a margin of safety and security by eliminating exposed pipeline segments.	While buried fault crossings are technologically feasible, the proposed design for the two fault crossings in the ROW is engineered to the specific fault conditions and represents the best solution to seismic risks.
PL-93	Option to time pipe staging to avoid seasonal presence of Beluga whales in critical habitat.	Minimize impacts to Cook Inlet Belugas.	Option not forwarded as an action alternative because it is a potential mitigation measure that would be considered by NMFS for any action alternative.

Table C-23: Above-ground Infrastructure and Facilities Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
PL-94	An option to house construction workers in existing lodges.	Could reduce the environmental effects of constructing and operating camps for construction workers.	This option is outside of the Purpose and Need for this project.
PL-96	Avoid wetlands in the positioning of temporary construction camps.	A design feature or mitigation action that would reduce wetlands impacts associated with construction of camps for construction workers.	Wetland avoidance will be required for construction camps during final design and Corps Section 404 permitting processes for any action alternatives. It is being retained as mitigation but is not an action alternative.
PL-99	Minimize the use of culverts and associated fill in flowing waterways.	A design feature or mitigation action that would reduce impacts associated with stream crossings.	As a design feature, each stream crossing would be designed and constructed to achieve regulatory standards for flow and fish passage.
PL-102	Construct temporary access roads using geotextile, “Chip Seal” “High Float” or paving.	A design feature or mitigation action that would reduce erosion, sedimentation and dust impacts.	Other operational measures are available to control erosion and minimize dust and could be employed as mitigation measures.
PL-105	Seasonal timing restrictions on blasting.	Could reduce the noise related effects of blasting.	Option is not included as a potential “Action Alternative” but is retained for consideration as a mitigation action both line-wide and for site specific application.
PL-106	Reduce the total number of material sites by maximizing the distance between them.	A design feature or mitigation action that would reduce the number of material sites	This would increase material haul distances and associated impacts. Also, it would not decrease the overall surface area impacts of material sites.

Table C-23: Above-ground Infrastructure and Facilities Options Eliminated from Consideration

Option No.	Option Description	Why Considered	Rationale for Elimination
PL-109	Construct a gas pipeline laid on the ground and not buried.	To minimize the environmental effects of trenching.	The Corps consulted with Pipeline Hazardous Materials and Safety Administration (PHMSA) regarding permittability of such an installation and received a reply on October 7, 2013: USDOT Gas Code requires: • soil cover unless it has safe guards for damage prevention; • a cathodic protection system; • protective coating of the pipeline; and • and isolated from ground (not laying on ground). Pipeline would probably need a special permit to operate above ground. The Corps prepared a Memorandum for the Record on October 21, 2013, concluding as follows: The Corps has determined that the on-ground natural gas pipeline alternative is not a reasonable alternative from a NEPA standpoint. Therefore, it will not be carried forward for detailed NEPA analysis as a potential alternative for the Donlin Gold Mine proposed natural gas pipeline. (See also PL-56 for consideration of an above-ground gas pipeline option.)
PL-110	Construct a diesel pipeline parallel to the natural gas pipeline.	Would eliminate the need to barge diesel.	This option would build two pipelines; one for natural gas as proposed and another parallel line transporting diesel. The two pipeline option was evaluated and the cost for purchasing and constructing two pipes makes the option economically infeasible.

Abbreviations:
INHT = Iditarod National Historic Trail
NEPA = National Environmental Policy Act
NMFS = National Marine Fisheries Service
PHMSA = Pipeline and Hazardous Materials Safety Administration
PL = pipeline
ROD = record of decision
ROW = right-of-way
USDOT = U.S. Department of Transportation